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# **AUSTROBAILEYA**

**A Journal of Plant Systematics**



**Queensland Herbarium**



**Queensland Government**

Department of Environment and Resource Management

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**Volume 8**

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# Taxonomic revision of Australian Myrsinaceae: *Ardisia* Sw. and *Tetrardisia* Mez

Betsy R. Jackes

## Summary

Jackes B.R. (2009). Taxonomic revision of Australian Myrsinaceae: *Ardisia* Sw. and *Tetrardisia* Mez. *Austrobaileya* **8(1): 1–23**. In this revision of *Ardisia* Sw., in Australia, eight species are recognized. This includes *Ardisia sanguinolenta* Blume which occurs on Christmas Island and other non-Australian areas, and two introduced and naturalised species *A. crenata* Sims and *A. elliptica* Thunb. Five species are restricted to Queensland and northern New South Wales. *Ardisia brevipedata* ?var. *depauperata* Domin is newly recognized as the species *Ardisia depauperata* (Domin) Jackes. *Ardisia bifaria* is again included in the genus *Tetrardisia* as *T. bifaria* (C.T.White & W.D.Francis) C.T.White. Descriptions, illustrations and distribution maps of all Australian mainland species are provided, as well as a species identification key.

Key Words: Myrsinaceae, *Ardisia*, *Ardisia depauperata*, *Tetrardisia*, *Tetrardisia bifaria*, Australian flora, taxonomy, nomenclature, identification keys

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## Introduction

*Ardisia* Sw. is a large genus with 250–300 species in the family Myrsinaceae (Ericales). Mez (1902) divided the genus into 14 subgenera. Hu (1999) in a review of Asiatic *Ardisia* considered that although there were exceptions, these divisions worked reasonably well. Ståhl & Anderberg (2004) in a phylogenetic review of the Myrsinaceae recognized a number of these subgenera as genera, including the previously recognized genus *Tetrardisia* Mez.

*Ardisia* and *Tetrardisia* as circumscribed by Ståhl & Anderberg (2004) can be distinguished from other genera in the family by a combination of morphological characters: inflorescence a raceme or panicle (although it may be much reduced); corolla lobes fused at the base, imbricate and twisted to the right; staminal filaments short; style filiform, at least twice as long as the ovary. The two genera may be distinguished with the following key.

## Key to *Ardisia* and *Tetrardisia* in Australia

|                                                          |                    |
|----------------------------------------------------------|--------------------|
| Leaves distinctly petiolate; flowers 5-merous . . . . .  | <b>Ardisia</b>     |
| Leaves sessile or subsessile; flowers 4-merous . . . . . | <b>Tetrardisia</b> |

## Materials and methods

This revision was based on an assessment of morphological characters from about 350 dried herbarium specimens, as well as from fresh material and field observations. Herbarium specimens were examined from the following herbaria BRI, CANB, CNS (formerly QRS), K, L, MEL, MO and NSW. Acronyms used

here to indicate herbaria holding particular specimens are those listed by Holmgren *et al.* (1990). Species in this paper are listed alphabetically. All measurements are based on dried material unless otherwise stated. All measurements of the peduncle refer to the peduncle + rhachis.

Secretory structures of a schizogenous origin are present in all organs; however, they are uncommon in anthers of all species examined. These structures are referred to

here as glands. All were examined under a microscope and it was noted that there was some variation in shape and colour between species, but these characters were constant within a species. All observations are based on dried material unless otherwise noted. In thick leaves it was often hard to discern the small, globular, deep red glands, but the presence of larger globular and lineate glands were easily observed on the surface. When viewed with a hand lens or the naked eye they often appear as black dots or streaks. Present on all leaves were capitate ‘scales’ sunken into the surrounding epidermis. These ‘scales’ were recorded for *Ardisia pachyrrhachis* (F.Muell.) F.M.Bailey by Blüthen & Reifenrath (2003) as extrafloral nectaries. Uniseriate trichomes were observed on various organs, but chiefly on the corolla tube interspersed with the staminal filaments. Glandular papillae may be present on various organs as on the pedicels of *A. bakeri* C.T.White.

### Taxonomy of *Ardisia*

*Ardisia* comprises about 250 species as circumscribed by Ståhl & Anderberg (2004). These occur in tropical and subtropical areas, particularly in Southeast Asia, and the Pacific Islands east to Fiji. Although well developed in the Asian region several representatives are found in tropical America. Five species are endemic to mainland Australia. Two species, *A. crenata* Sims and *A. elliptica* Thunb., which were introduced as garden plants are now weeds of environmental concern. Another species *A. colorata* Roxb. occurs on Christmas Island as well as in India, southern China and areas east to Java.

**Breeding systems:** Self-compatibility appears to be common in the genus although only about seven species have been studied (Bawa 1974; Bawa *et al.*, 1985; Pascarella 1997). In *Ardisia elliptica* Thunb. at least 75% of the seeds produced from experiments for autogamy were viable and this was higher than in the other species tested (Pascarella 1997). He also showed that in several species seed set was higher when cross-pollination occurred. Protogyny, where the stigma extends beyond the unopened corolla a day prior to anthesis, has been reported for a number of species (Tomlinson 1974; Pascarella 1997). Although

no detailed studies have been conducted, the stigma of *A. brevipedata* F.Muell., has been observed to extend beyond the corolla prior to anthesis (*pers. obs.*).

**Ardisia** Sw., *Nov. Gen. Sp. Prodr.* 48 (1788), *nom. cons.* **Type:** *Ardisia tinifolia* Sw. (*nom. cons.*).

*Bladhia* Thunb., *Nov. Gen. Pl.* 1: 6 (1781). **Type:** *Bladhia japonica* Thunb.

Small trees or shrubs, rarely climbing (non-Australian); branchlets usually flattened at the point of attachment to the stem. Leaves petiolate, simple, alternate, spirally arranged or distichous, usually coriaceous, margins entire to crenate, sometimes undulate, surface glabrous or with peltate glandular scales, rarely with hairs (non-Australian); glands globose and/or lineate, sometimes obscure. Inflorescence a raceme, usually appearing umbelliform or paniculate (non-mainland Australia), often terminating in short lateral branches, in non-Australian species may be cymose, appearance often depends on the spacing of the pedicels. Flowers bisexual, 5 (rarely 6)-merous, pedicellate. Calyx free or fused at the base, persistent, glands usually present. Corolla rotate, campanulate to urceolate (non-Australian), white to pink, lobes fused at base, imbricate in bud, overlapping to the right and often recurved or widely spreading after anthesis, glands present. Stamens free or adnate to the corolla tube near the base; filaments short, rarely absent, base usually fused to form a short tube or rim fused to the corolla-tube; anthers sagittate, introrse, longitudinally dehiscent, rarely opening by pores (non-Australian), erect, often forming a cone around the style. Ovary superior, globose to conical tapering into a filiform style which is sometimes exerted from the bud; the style is more than twice as long as the ovary: stigma punctiform, placenta basal; ovules few to numerous embedded in the placenta, uniseriate to multiseriate. Fruit a drupe, globose to subglobose, with a persistent style or scar at the apex, endocarp hard. Seed 1, endosperm firm, embryo transverse, cylindrical.

**Etymology:** from the Greek *ardis* - sharp or a point, referring to the shape of the stamens and/or the protruding slender style.

**Key to species of *Ardisia* in Australia including Christmas Island and naturalised species**

- 1 Leaves distichous or 2-ranked . . . . . **1. *A. bakeri***
- 1. Leaves spirally arranged, not distichous or 2-ranked . . . . . 2
- 2 Margins of lamina crenate with glands/nodules in the sinuses . . . . . **3. *A. crenata***
- 2. Margins of lamina usually entire, glands/nodules absent from sinuses . . . . . **3**
- 3 Corolla lobes shorter than corolla-tube . . . . . **6. *A. fasciculata***
- 3. Corolla lobes longer than the corolla-tube . . . . . 4
- 4 Inflorescence paniculate (Christmas Island) . . . . . **8. *A. sanguinolenta***
- 4. Inflorescence a short raceme, often appearing subumbellate or condensed . . . . . 5
- 5 Leaf margins recurved, pedicels >10 mm long . . . . . **7. *A. pachyrrhachis***
- 5. Leaf margins not revolute, pedicels <10 mm long . . . . . 6
- 6 Mature fruits purplish-red to black . . . . . **5. *A. elliptica***
- 6. Mature fruits white, pink to red . . . . . 7
- 7 Flowers usually 12–25 per inflorescence, flowers 3–4 mm long . . . . . **2. *A. brevipedata***
- 7. Flowers usually 5–8 per inflorescence, flowers 2–2.5(–3) mm long . . . . . **4. *A. depauperata***

**1. *Ardisia bakeri*** C.T.White, *Proc. Roy. Soc. Queensland* 53: 223 (1942); *Ardisia racemosa* F.Muell. ex R.T.Baker *nom. illeg., non* Sprengel (1824), *nec* Mez (1902), *Proc. Linn. Soc. N.S.W. Series* 2, 27(4): 380 (1902). **Type:** New South Wales. NORTH COAST: Tumbulgum, October 1897, *W.Bäuerlen* 1983 (holo: NSW259659; iso: BRI, K).

**Illustration:** Harden (2000: 502).

Shrub or small tree, 1.5–5(–9.5) m tall; bark grey, smooth; branching sparse to abundant, branchlets usually zig-zag, some very small leaves usually present near base of branchlets. Leaves distichous, petiolate; petiole 3–7 mm long, reddish, weakly marginate, flat on adaxial surface. Lamina chartaceous, elliptic, often somewhat asymmetrical, (1.5–) 4.8–12.5 cm long, (0.7–) 1.5–3.6 cm wide; apex obtuse to acuminate, base cuneate, adaxial surface dull to glossy green, abaxial surface paler, glabrous except for scattered scales, margins may be undulate and weakly recurved, midrib depressed on adaxial surface, prominently raised on abaxial surface; lateral veins may be relatively inconspicuous, 13–25 pairs on either side of the midrib irregularly looping near the margins; glands of both types, irregularly globular, reddish and more frequent near the margins, often visible as bumps on the

adaxial surface, when lineate appearing black with a length:width ratio up to 10:1, chiefly visible on the abaxial surface, the latter are not always present in every leaf. Inflorescence an axillary raceme, appearance depends on the spacing of the pedicels, may appear subumbellate or congested, to 2 cm long; flowers 3–7(–10) per inflorescence; peduncle and pedicels reddish; pedicels filiform, 2–5(–10) mm long, scattered glandular papillae often present, glands dark red, globular to shortly lineate, density variable; subtending bracts chartaceous and soon caducous, *c.* 1.5 mm long and 0.75 mm wide at base; glands globular reddish, margins scarious. Flowers 5-merous, 2–3 mm long. Calyx 5-lobed, green; tube 0.1–0.2 mm long, lobes triangular 1–1.5 mm long, 0.75–1 mm wide at base, glands globular red to dark red, margins scarious. Corolla rotate, white to pinkish-red; tube 0.2–0.4 mm long, lobes usually widely spreading after anthesis, 2–2.5 mm long, 1–1.5 mm wide, median portion of lower half of lobe thickened on adaxial surface, papillae present, uniseriate hairs present at junction of corolla-tube and lobes; glands pale to dark red, margins scarious. Stamens opposite the petals; base of filaments fused to form a small rim, free portion flattened, *c.* 0.2 mm long; anthers 2-locular, cordate-sagittate tapering

into a subulate, sometimes curved point, *c.* 2 mm long and 0.75 mm wide at base, 0–4 reddish globular glands may be present on the connective. Ovary globose to conical tapering into the style, *c.* 1 mm diameter; glands globular to shortly lineate, dark red to black; style 1.5–2 mm long, glands usually sparse; stigma punctiform. Ovules multiseriate, 9–14 embedded in the placenta. Fruit globular, 5–7(–10) mm diameter, black at maturity, glands globular to shortly lineate, dark red to black, style persistent to 2 mm long. Seed globular, *c.* 4 mm long and 4 mm diameter. **Fig. 1.**

**Additional selected specimens (from *c.* 21 examined):**

**Queensland.** MORETON DISTRICT: Lyrebird Ridge Road, Springbrook, Nov 2000, *Bean 16995* (BRI, MEL); near Lyrebird Ridge Road, Springbrook, Dec 1990, *Bird & Tucker s.n.* (BRI [AQ502600], CANB [CBG]); Lyrebird Ridge Road Pottery, Springbrook, Dec 1990, *Forster PIF7703* (BRI, NSW); Tomewin on Queensland side of Queensland/New South Wales border, Sep 1984, *Jones s.n.* (BRI[AQ440726]). **New South Wales.** NORTH COAST: Tweed River, May 1901, *Campbell 105* (NSW); Couchy Creek below Sphinx Lookout, south side of Springbrook plateau, May 1977, *Floyd 353* (NSW); on NSW/QLD border south of Mt Cougal, Aug 1986, *Floyd AGF2148* (BRI, NSW); *c.* 1 km along QLD–NSW border track from Numinbah gate, Nov 1982, *Guymer 1810 & Jessup* (BISH, BRI, CANB, L, NSW).

**Distribution and habitat:** In the late 19<sup>th</sup> Century and early 20<sup>th</sup> Century collections of *Ardisia bakeri* were made in rainforest along the gullies associated with the Tweed River. However, no recent collections have been made in these areas. Extant populations appear to be restricted to the Springbrook Plateau (28°12'S, 153°18'E) and associated areas of the McPherson Range (**Map 1**). It is locally common in complex or notophyll vine forests at altitudes up to 1000 m. Soils are chiefly basaltic in origin. Conservation status is listed as **Rare** in both Queensland and New South Wales.

**Phenology:** The main flowering period is from September to November; fruits have been collected from December to May.

**Notes:** This species is readily identified by the 2-ranked and petiolate leaves. It is the only species examined where the median region of the adaxial surface of the corolla lobes is thickened and papillate.

White (1942) renamed this species on discovery that Baker's name was invalid. Although at the time he stated "comb.nov." basing his new name on Baker's invalidly named species, the name has been treated as a *nomen novum* and this was undoubtedly the intention at the time.

**Etymology:** Named after R.T. Baker (1854–1941) an economic botanist, who became curator of the Sydney Technological Museum and also a forestry lecturer at the University of Sydney. He was awarded the Mueller medal in 1921 and the Clarke Medal in 1922 for his contributions to chemotaxonomy particularly of the eucalypts.

**2. *Ardisia brevipedata*** F.Muell., *Fragm.* 6: 163 (1868); *Bladhia brevipedata* (F.Muell.) F.Muell. *Vict. Nat.* 8: 16 (1891); *Ardisia brevipedata* var. *brevipedata* Domin, *Biblioth. Bot.* 89: 502 (1928). **Type:** Queensland. NORTH KENNEDY DISTRICT: Rockingham Bay, 16 October 1868, *Dallachys.n.* (lecto [here chosen]: MEL1612562; isolecto: K, MEL162563).

**Illustration:** Cooper & Cooper (2004: 334).

Shrub or small tree 1.5–3(–6) m tall; bark smooth; branches tend to be held at more than 45° to the main stem, branchlets often with a slight zig-zag. Leaves alternate, petiolate; petiole 0.5–7(–10) mm long, reddish, weakly marginate, flat on adaxial surface. Lamina chartaceous, elliptic to obovate, 4.4–16.9 cm long, 1.1–4.7 cm wide, adaxial surface glossy green, abaxial surface paler, glabrous except for scattered scales; apex obtuse to acuminate, base cuneate, margins smooth, may be slightly recurved, midrib flat or slightly depressed on adaxial surface, raised on abaxial surface; lateral veins relatively inconspicuous, more than 20 per side of midrib; glands pellucid when fresh, appearing black when dry, from irregularly globular to lineate, with a length: breadth ratio up to 12:1. Inflorescence axillary, subumbellate to umbellate to 2 cm long; flowers 12–25 per inflorescence, if less then by abortion, peduncles 2–10 mm long, reddish; pedicels filiform, 5–12 mm long, reddish, glands globular to shortly lineate, dark red often appearing black; subtending bracts soon caducous, 1–2 mm long, 0.5–1 mm wide, glands dark. Flowers 5-merous rarely 6,



**Fig. 1.** Representative specimen of *Ardisia bakeri* (Bean 16995 [BRI]).

3–4 mm long. Calyx 5-lobed; tube 0.25–0.5 mm long, broadly triangular, lobes spreading after anthesis, 0.75–2 mm long, margins scarious, glands globular to shortly lineate, mostly dark red, occasionally orange. Corolla rotate, white to cream to pale pink; tube c. 1 mm long, lobes spreading after anthesis to 3 mm long, c. 1 mm wide, apex often weakly reflexed, glands dark red often appearing black, chiefly lineate, length variable. Stamens connivent around the style; base of filaments fused to form a rim, attached to corolla-tube, uniseriate hairs dense on rim, free portion of filament 0.2–1 mm long; anthers 1.5–2 mm long, c. 1 mm wide at base, occasional dark gland present on connective, apex apiculate. Ovary globose, 1–1.5 diameter, tapering into style, dark-coloured. Style 2–3 mm long, twisted near apex, red-coloured when fresh; glands if present, dark red; stigma punctiform. Ovules uniseriate, 2–4 embedded in placenta, only 1 maturing. Fruit globular to depressed globular, 4–7 mm long, 5–7 mm diameter, red at maturity, glands dark red and usually dense. Seed depressed globular, 4–5 mm long, 5–6 mm diameter, testa brown. *rambling spearflower*. **Fig. 2.**

**Additional selected specimens (from c. 118 examined):**  
**Queensland.** COOK DISTRICT: 1 km SW of the Twin Forks, headwaters of the Annan River, Jun 1992, *Forster PIF10741 et al.* (BRI); Home Rule, base of Mt Hedley, 3 km E of Rossville, Apr 1999, *Forster PIF24261 & Booth* (BRI); Headwaters of Coopers Creek, 3.5 km W of Thornton Beach, Jun 1988, *Forster PIF4385 & Tucker* (BRI, CANB, L); Castle Rock, 33.7 km from Mt Carbine road on road to Spencer Creek Forestry Camp, Mount Windsor Tableland, Whypalla, Nov 1990, *Holland 14 & Hind* (NSW); S.F.R. 675, East Mulgrave L.A., Jan 1977, *Gray 269* (BRI); Longlands Gap, S.F. 353, Jun 1995, *Forster PIF16786* (BRI); N.P.R. 904, Parish of Palmerston, Feb 1997, *Hyland 15588* (CNS); NW of Tully, May 2005, *Ford 4643* (CNS). NORTH KENNEDY DISTRICT: Murray Falls, Murray Upper, Dec 1987, *Irvine 2334* (CNS); Hinchinbrook Island, c. 2 km NW of Mt Diamantina, Dec 2000, *Kemp TH2582 & Kutt* (JCT); Burgoon L.A., Garrawalt, Jul 1975, *Sanderson 675* (CNS); Near Gumburu Environmental School, Paluma, Dec 2005, *Jackes 431* (JCT).

**Distribution and habitat:** *Ardisia brevipedata* is endemic to north-east Queensland where it occurs as an understory shrub or small tree. It is usually found on the margins or in rainforest habitats usually above 500 m altitude, although it has been collected in

lowland areas. This widespread species extends from Paluma in the south (c. 19°S) to the Bloomfield – Windsor Tableland area (c. 15°49'S) in the north (**Map 2**).

**Phenology:** Flowers have been collected in every month but chiefly from October to January. Fruits have been collected throughout the year.

**Notes:** Hu (1999) considered that *Ardisia apus* Mez from New Guinea was synonymous with *A. brevipedata*; however, the type description of the former refers to gland-like thickish points on the margin of the adaxial surface. Such glands were absent for all specimens of *A. brevipedata* examined. Unfortunately the type specimen of *A. apus* has been lost and according to Sleumer (1988) no other collections had been made. The type specimen, *Ledermann 12015* was collected in the Schrader mountains of the Sepik district in Papua New Guinea. Hu (1999) indicates that collections of *A. apus* have been recorded from the Papua New Guinean provinces of East Sepik, Morobe and Milne Bay and Hollandia province in Indonesian Papua.

**Etymology:** From the Latin *brevi* – short and *pedatus* – foot, referring to the peduncles which are often short.

**3. *Ardisia crenata* Sims, *Bot. Mag.* 45: t. 1950 (1817); *Bladhia crenata* (Sims) H.Hara, *Enum. Spermatoph. Jap.* Part 1:75 (1948). **Type:** China (Based on Plate 1950, *Bot. Mag.*, from material collected/ cultivated by Loddiges – Cambridge Botanical Garden).**

Shrub to 1.5(–3) m tall; stem glabrous or initially with minute glandular papillae. Leaves spirally arranged, petiolate; petiole narrowly marginate, 6–10 mm long; lamina coriaceous, elliptic-lanceolate, oblanceolate, rarely ovate, 6–20 cm long, 2–4 cm wide, discolorous, glabrous except for peltate scales more common on abaxial surface than adaxial surface; apex acute to acuminate, base cuneate, margins crenate, undulate and revolute, nodules or secretory trichomes prominent in the sinuses; midrib raised in a shallow groove on adaxial surface, raised on abaxial surfaces; lateral veins 12–18 pairs on either side of the midrib, looping near



**Fig. 2.** Representative specimen of *Ardisia brevipedata* (Forster & Booth PIF24261 [BRI]).

the margin to form a distinct marginal vein; glands irregularly globose, reddish-orange, visible as bumps on both surfaces when dry. Inflorescence terminates a lateral shoot, umbelliform to 4 cm long and 10 cm wide, 6–14 flowers per umbellate cluster; subtending bracts 2–3 mm long, *c.* 1.5 mm wide at base, strongly keeled mid section, glands variable dark-coloured. Flowers 5-merous, 6–7 mm long; pedicels 6–10 mm, glands both dark lineate and globular, chiefly orange-coloured. Calyx campanulate, to 2 mm long and 1.5 mm wide at base, glands globular dark red in lower portion, orange towards apex. Corolla rotate, white; tube *c.* 0.2 mm, lobes spreading, *c.* 6 mm long, 4 mm wide at base, glandular papillae in lower portion, glands globular to shortly lineate, dark red and/or orange-coloured. Stamens opposite the petals; base of filaments fused to form a rim attached to the corolla-tube, free portion of filament flattened, *c.* 1 mm long; anthers to 3 mm long, *c.* 1.5 mm wide towards the base, globular dark red glands on abaxial surface, dehiscence initially by small apical pores then splitting longitudinally. Ovary conical, *c.* 1 × 1 mm, tapering into style, glands orange; style *c.* 2 mm long, orange glands present; ovules 3–5 at base of depressed-globose placenta. Fruit globose, 6–8 mm diameter, red, glands dark red, scattered. Seed depressed globular, *c.* 5 mm long, 5–6 mm diameter, testa light brown. *coralberry*, *spiceberry*. **Fig. 3.**

**Selected specimens (from *c.* 26 examined): Queensland.** COOK DISTRICT: Environmental Park, Kuranda, Nov

1992, *Swarbrick s.n.* (BRI [AQ533671]); 100 Herberton Road, Atherton, May 1997, *Gray 7172* (CNS); Weinets Creek, Babinda, Oct 2000, *Forster PIF26375 et al.* (A, BRI, K, MEL). NORTH KENNEDY DISTRICT: Alcock Forest Reserve, rafting access point 9, 5.2 km from Tully River camping area, Feb 2002, *Ford AF3277 & Holmes* (BRI). PORT CURTIS DISTRICT: Richter's Road, N of Watalgan, Aug 1996, *Bean 10515 & Baumgartner* (BRI). WIDE BAY DISTRICT: Near Lake Cooroibah, Aug 1986, *Sandercoe C1187 & Milne* (BRI). MORETON DISTRICT: *c.* 1 km W of Beerwah, Caloundra Shire, Jun 2003, *Sanders s.n.* (BRI [AQ776446]); Mt Cougal N.P., south west of Currumbin, *Bean 16671* (BRI). **New South Wales.** NORTH COAST: 700 m along the Mullumbimby road from its junction with the Pacific Highway, Dec 1994, *Parker s.n.* (NSW364039).

**Distribution and habitat:** A native of the Asian region extending from India to Japan and into the Malaysian area (Malesian subkingdom). This commonly cultivated plant has become naturalised, chiefly in urban localities as well as along margins of rainforest and in wet sclerophyll forest in moist shady sites. It is currently found in eastern Australia from *c.* 16°30'S to 29°S (**Map 3**). Since fruits are dispersed by birds, this species has the potential to spread into more localities.

**Phenology:** Flowering occurs in spring and summer. Ripe fruits present from autumn to early summer.

**Notes:** *Ardisia crenata* has often been confused in the literature with *A. crispa* (Thunb.) A. DC. The source of this confusion is outlined by Walker (1939). Based on descriptions by Chen & Pipoly (1995) and Yang (1999), supplemented by herbarium material these two species may be distinguished as follows:

- |                   |                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A. crenata</b> | Rhizomes absent; branchlets glabrous; leaf lamina elliptic-lanceolate to oblanceolate, rarely ovate; lateral veins 12–18 pairs on either side of the midrib uniting to form a distinct marginal vein; marginal glands/nodules prominent in the sinuses pale when dry; anthers with reddish glands on the abaxial surface.                                             |
| <b>A. crispa</b>  | Creeping rhizomes present; branchlets pubescent; leaf lamina narrowly oblong-lanceolate to linear-lanceolate, rarely elliptic-lanceolate; lateral veins <i>c.</i> 8 pairs on either side of the midrib, marginal veins absent or obscure if present; marginal glands/nodules in the sinuses small, when dry almost black; anthers lack glands on the abaxial surface. |

All specimens in Australian herbaria with crenate margins and nodules in the sinuses were identified as belonging to *Ardisia crenata*. Kitajima *et al.* (2006) suggest that

the selection of desirable traits for cultivation may have increased the potential invasiveness of this species.

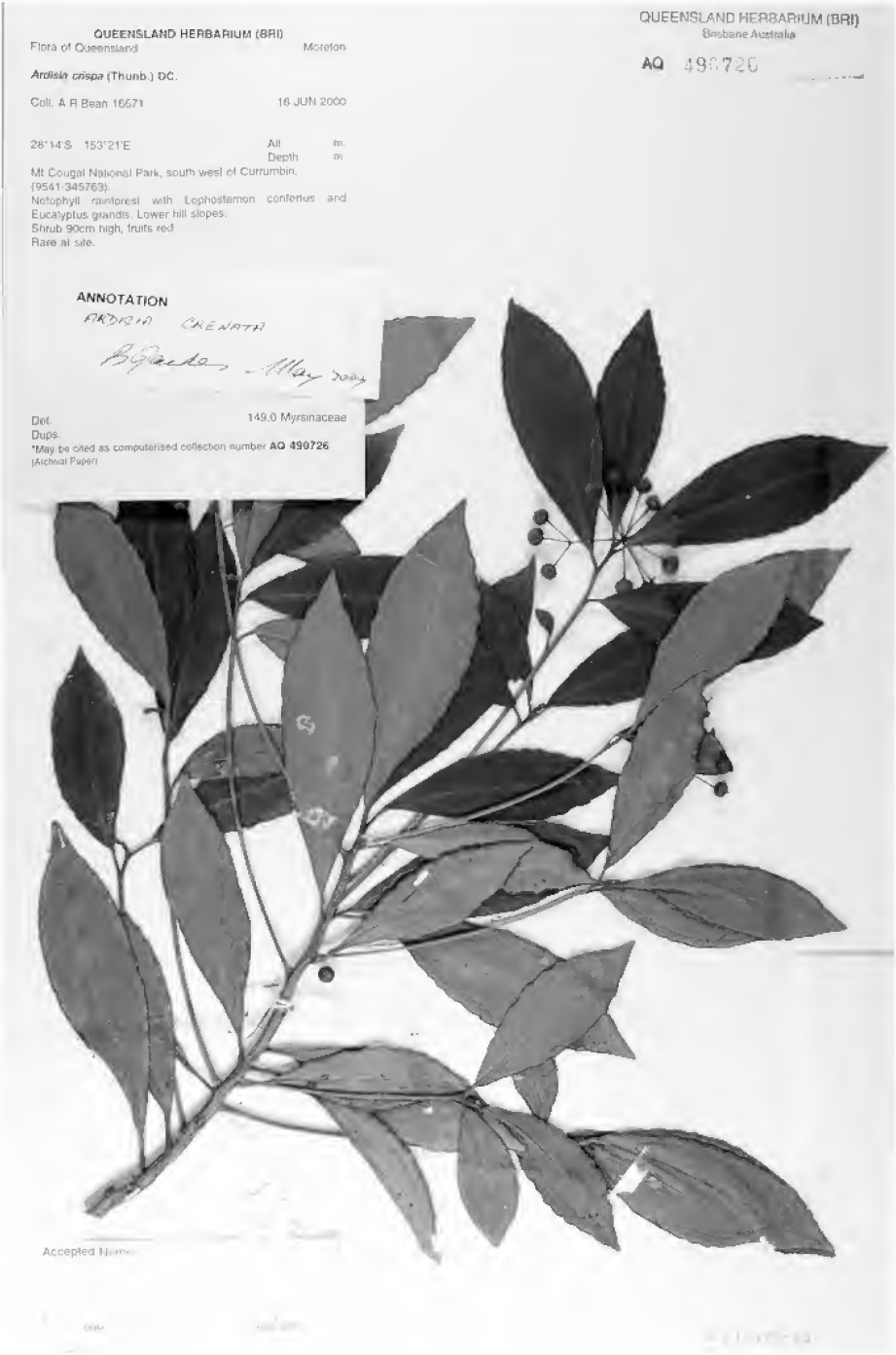


Fig. 3. Representative specimen of *Ardisia crenata* (Bean 16671 [BRI]).

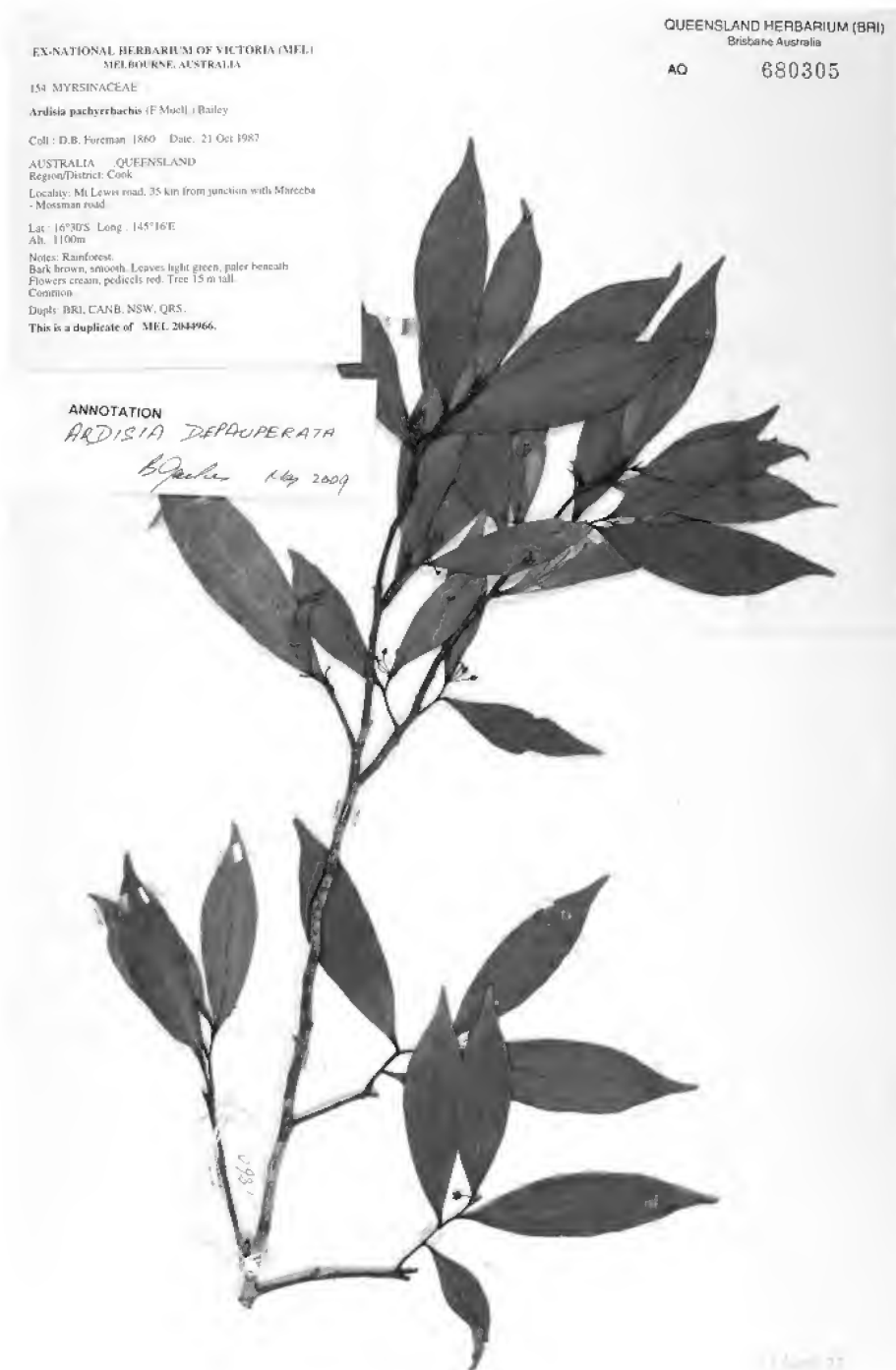


Fig. 4. Representative specimen of *Ardisia depauperata* (Foreman 1860 [BRI]).

**Etymology:** The name refers to the markedly crenate margin of the leaves.

**4. *Ardisia depauperata* (Domin) Jackes *status nova*; *Ardisia brevipedata* ?var. *depauperata* Domin, *Biblioth. Bot.* 89: 502 (1928). **Type:** Queensland. COOK DISTRICT: montes Bellenden-Ker ["Ein Strauch in der mittleren Region des Bellenden-ker"], December 1909, *K. Domin* 7657 (holo: PR530275 [photograph seen, photos at BRI, CANB, CNS and NSW]).**

*Ardisia* sp. (South Mary LA B.P. Hyland 8778) (Bostock & Holland 2007).

Shrub or small tree 1.5–4 m tall; bark smooth; stems often sprawling with adventitious roots, branchlets usually zig-zag. Leaves alternate, petiolate; petiole 1–3(–4) mm long, reddish, weakly marginate, flat on adaxial surface. Lamina chartaceous, lanceolate to elliptic, often slightly asymmetrical, (4.6–)6.3–9.1(–11.2) cm long, 1–2.1(–3) cm wide, adaxial surface glossy green, abaxial surface paler, glabrous except for scattered scales; apex acuminate to obtuse, base cuneate, margins smooth, midrib shallowly depressed on adaxial surface, raised on abaxial surface; lateral veins relatively inconspicuous when fresh, more than 15 per side of midrib. Glands pellucid when fresh, appearing black when dry, from irregularly globular to lineate, length:breadth ratio usually less than 3:1. Inflorescence axillary, subumbellate to 1 cm long; flowers 4–8 per inflorescence; peduncles 2–4 mm long, reddish; pedicels filiform, 5–10 mm long, reddish, glands shortly lineate, dark red often appearing black; subtending bracts soon caducous, 1–1.5 mm long, 0.5–1 mm wide, glands dark-coloured. Flowers 5-merous, 2–2.5 mm long. Calyx 5-lobed; tube 0.25–0.5 mm long, broadly triangular; lobes spreading after anthesis, broadly triangular, c. 0.5 mm long, 0.5–0.75 mm wide, margins scarious, glands globular to shortly lineate, mostly dark red, occasionally some small globular, orange glands near margin. Corolla rotate, white to cream often with a pink tinge; tube c. 0.5 mm long, lobes spreading after anthesis to 1.5–2(–2.5) mm long, 1–1.5 mm wide, apex often weakly reflexed, glands dark red often appearing black, chiefly lineate, length variable, occasional small globular

orange gland near margin. Stamens opposite the petals, connivent around the style; base of filaments fused to form a rim that is fused to corolla-tube, uniseriate hairs present on rim, free portion of filament c. 0.2 mm long; anthers c. 1.5 mm long and 1 mm wide at base, apex apiculate. Ovary globose, 0.75–1 mm diameter, tapering into style, dark-coloured. Style c. 1.5 mm long, shallow ridges present, red when fresh, no glands observed; stigma punctiform. Ovules uniseriate, 3 or 4 ovules embedded in placenta, only 1 maturing. Fruit globular to depressed globular, 5–6 mm diameter, red at maturity, glands dark red, usually dense. Seed globular, 4–5 mm diameter, testa brown. **Fig. 4.**

**Additional selected specimens (from c. 23 examined):** **Queensland.** COOK DISTRICT: S.F.R. 144, Fantail L.A. Mt Windsor Tableland, Mar 1981, *Unwin 757* (CANB, CNS, NSW); S.F.R. 144, Mt Windsor, Jul 1976, *Unwin 15* (CNS); Mt Spurgeon, Sep 1936, *White 10597* (BRI); Root's Creek, Jan 1936, *Flecker s.n.* (CNS1984); S.F.R. 143, South Mary L.A., May 1976, *Hyland 8778* (BRI, CANB, CNS, NSW); Mt Lewis road, 35–36 km from Rex Highway, Carbine L.A., Aug 1986, *Weston 656 et al.* (BRI, CNS, NSW); S.F.R. 143, South Mary L.A., Feb 1974, *Hyland 7206* (CNS); Mt Lewis road, 35 km from junction with Mareeba – Mossman road, Oct 1987, *Foreman 1860* (BRI, CANB, CNS, MEL, NSW); Druggies track, Leichhardt L.A., T.R. 66, 11 km along Mt Lewis road, Jun 1995, *Forster PIF16761 et al.* (BRI); T.R. 66, Mt Lewis, Aug 1078, *Moriarty 2413* (CNS); Tinaroo Range, Aug 1971, *Moriarty 806* (BRI, CANB); Head of Robson Creek, 5.8 km past hoop pine triangle, NE end of Tinaroo Dam, Mar 1988, *Forster PIF3933 et al.* (BRI, CANB); S.F.R. 185, Edith L.A., Mar 1975, *Irvine 1254* (BRI, NSW); S.F.R. 194, Barron, Sep 1992, *Hyland 14567* (CNS, NSW); Mt Bellenden Ker, 1887, *Sayer s.n.* (MEL1612570); Tarzali, Feb 1918, *White s.n.* (BRI [AQ91824], CANB262869).

**Distribution and habitat:** This understory shrub or small tree has only been collected in or associated with rainforest, chiefly at altitudes above 800 m. It is endemic to the Wet Tropics of North Queensland. Although not widely collected it is probably more common than collections indicate. It has been recorded in areas between the Mount Windsor Tableland area (16°12'S) south to the Evelyn Tableland area (17°35'S) (**Map 4**).

**Phenology:** Flowering specimens have been collected most months of the year but particularly in summer and autumn. Fruiting specimens chiefly collected from May to August.

**Notes:** This species may be distinguished from the related species *Ardisia brevipedata*, by the reduced number of flowers per inflorescence (4–8 versus 12–25) and by the usually smaller flowers. The distribution of these two species overlap within the Wet Tropics; however, *A. brevipedata* is more widespread. Although there is an overlap in leaf size, the leaves in this species are generally smaller than in *A. brevipedata*. Sterile herbarium material may be difficult to assign; however, little difficulty has been experienced in the field. An excellent collection is *Hyland 8778* and in the absence of the type in Australia this collection should be used as a reference, together with photos of the type specimen which have been lodged at BRI, CANB, CNS and NSW.

**Etymology:** From the Latin *depauperatus* – reduced, starved, referring to the smaller number of flowers in the inflorescence.

**5. *Ardisia elliptica* Thunb., *Nov. Gen. Pl.* 8: 119 (1798). **Type:** Sri Lanka (holo: UPS-Thunberg herbarium, sheets 5320, 5321 [microfiche seen]).**

Shrub or small tree to 4 m tall, bark grey; branchlets somewhat angular, glabrous, young growth reddish. Leaves spirally arranged, petiolate; petiole (2–)5–12(–15) cm long, reddish, marginate, usually flat on adaxial surface; lamina chartaceous, oblanceolate to elliptic-lanceolate, (5–)8–13.2 cm long, (1.4–) 3–4.6 cm wide, adaxial surface glossy green, abaxial surface paler, glabrous except for some scattered scales; apex obtuse to acuminate, base cuneate, margins smooth, midrib flat or slightly depressed on adaxial surface, raised on abaxial surface; lateral veins relatively inconspicuous, 20–34 pairs on either side of the midrib, looping near the margin to form an intramarginal vein; glands globular to shortly lineate, length: breadth ratio to 4:1, pellucid when fresh drying to orange-red or red, visible as bumps on both surfaces of dried leaves. Inflorescence terminal or subterminal, umbellate to subumbellate, 4–5 cm long, flowers 6–11 per inflorescence; peduncle reddish 2–3.5 cm long; pedicels 8–17 mm long, often curved, reddish and pellucid glands drying red; subtending bracts to 2 × 2 mm, soon caducous. Flowers 5-merous, to

10 mm long. Calyx 5-lobed, green; tube 0.5–1 mm long; lobes rounded, 1.5–3 mm long, 1.5–2 mm wide at base, margins scarious and ciliolate, glands irregular drying red to very dark red. Corolla rotate, pale pink; corolla-tube c. 1 mm long, lobes spreading after anthesis, 7–9 mm long, 3–4 mm wide, glands drying reddish, dots or short streaks. Stamens opposite the petals; filaments c. 2 mm long, fused at base to form a short tube c. 0.5 mm long which weakly adheres to the corolla-tube and may alternate with 1–5 pink petaloid staminodes to 1 mm long; anthers connivent around the exerted style, 4–5 mm long and 1.5 mm wide tapering to an apiculate apex, septate, opening by introrse longitudinal slits, dark red glands obvious on the back. Ovary globular, c. 1 mm diameter, tapering to the style glands present; ovules multiseriate, 17–20 embedded in the placenta; style 5–9 mm long, glands prominent, stigma punctiform. Fruit depressed globular, 6–8 mm wide, 5–7 mm high, fleshy, green to dark pink to black at maturity. Seed, 5 mm diameter; testa brown, with pinkish tinge when fresh. *shoebutton Ardisia*. **Fig. 5.**

**Additional selected specimens (from c. 20 examined):** **Northern Territory.** Nhulunbuy, Town Lagoon, May 1996, *Cowie 7045* (BRI). **Queensland.** COOK DISTRICT: Weipa Campground, Apr 2004, *Waterhouse BMW6845* (BRI); Cassia Street, Edge Hill, Cairns, Apr 2001, *Woodward s.n.* (BRI [AQ669650]); Kennedy Highway, Atherton, Aug 2002, *Willeys s.n.* (CNS123780); Babinda, Mar 1998, *Jago 780* (CNS). SOUTH KENNEDY DISTRICT: Slade Point, Dunal System, Jun 1992, *Champion 727* (BRI). MORETON DISTRICT: Calamvale south of Brisbane, 1975 Beaudesert Road, Jul 2000, *White s.n.* (BRI [AQ 490024]).

**Distribution and habitat:** Originally found in Thailand, Vietnam, China, Taiwan, Japan, Philippines and Indonesia, this species has becomes a serious weed in many countries particularly on many Pacific Islands and in southern Florida (PIER 2008). In Australia it is naturalised in the Northern Territory and Queensland (**Map 5**). It prefers moist areas particularly in rainforest and associated areas. The black drupes are attractive to birds that disperse the seeds.

**Phenology:** Flowering occurs mainly in spring and summer. Fruits have been commonly collected in the late summer to late winter period.



**Fig. 5.** Representative specimen of *Ardisia elliptica* (Champion 727 [BRI]).

**Notes:** This species has been frequently misidentified and confused with both *A. humilis* Vahl and *A. solanacea* Roxb. Mez (1902) included *A. elliptica* Thunb., under *A. humilis*; although based on the original descriptions, they both have quite different inflorescences. A further source of confusion probably arose because Willdenow's specimens of *A. solanacea* represent two different species.

Mez (1902) places Willdenow herb., number 4883 under *A. humilis* and number 4883 under *A. solanacea* Roxb. *Ardisia elliptica* Bedd., is also a synonym of *A. solanacea* Roxb.; however, *A. elliptica* Thunb., *A. humilis* Vahl and *A. solanacea* Roxb., are all valid species and may be easily distinguished as follows.

**Etymology:** unknown.

- 
- A. elliptica** Branchlets angular; petioles marginate, 0.5–1 cm long; glands in lamina pellucid when fresh, drying red when viewed with reflected light, 12–34 lateral veins on each side of midrib, marginal vein present; inflorescence axillary, subumbellate to umbellate; glands in corolla red.
- A. humilis** Branchlets terete; petioles caniculate, 0.6–1 cm long; glands in lamina pellucid, inconspicuous, c. 12 pairs of lateral veins each side of midrib, marginal vein absent; inflorescence terminal or subterminal paniculate; glands in corolla pellucid to orange-coloured.
- A. solanacea** Branchlets prominently angled; petioles caniculate, 1–2 cm long; glands in lamina black, conspicuous, c. 20 pairs of lateral veins on each side of the midrib, marginal vein absent; inflorescence both terminal and axillary, paniculate to corymbose; glands in corolla dark red to black.

Detailed descriptions of both *A. humilis* Vahl and *A. solanacea* Roxb. may be found in Chen & Pipoly (1995).

**6. Ardisia fasciculata** C.T.White, *Proc. Roy. Soc. Queensland* 50: 80 (1939). **Type:** Queensland. COOK DISTRICT: Mt Spurgeon, September 1936, C.T.White 10673 (holo: BRI [AQ23414]).

Shrub or small tree. Leaves, alternate, spirally arranged, petiolate; petioles terete, 10–17 mm long; lamina coriaceous, broadly lanceolate to obovate, 7–10 cm long, 2.5–4 cm wide, glabrous on both surfaces except for peltate glandular scales on the abaxial surface; apex obtuse, base cuneate, margins entire, undulate, may be weakly revolute; midrib depressed on adaxial surface and raised on abaxial surface, lateral veins inconspicuous but visible on both surfaces when dry; glands not visible in dried leaves. Inflorescence an axillary fascicle, 3–6 flowered; peduncle c. 0.2 mm long; pedicels thick, angular 6–7 mm long and c. 1.5 mm wide, glands difficult to distinguish. Flowers 5-merous, c. 5 mm long; calyx campanulate; tube 0.75–1 mm long, lobes triangular, 1.25–

1.75 mm long, 1.25–1.75 mm wide at base, margins with glandular papillae, glands small, dark red. Corolla rotate; tube c. 2 mm long, lobes c. 1.5 mm long, densely papillate. Stamens equal in length to corolla; filaments flattened; anthers narrowly ovate, c. 1 × 1 mm. Ovary conical, c. 1 × 1.5 mm, glabrous, glands dark, stylar remains darkish. Ovules multiseriate, c. 14. Fruit not seen. **Fig. 6.**

**Distribution and habitat:** Known only from the type specimen, a small tree collected in rainforest on Mt Spurgeon, North Queensland. Despite some recent excursions to the area no additional specimens has been located.

**Phenology:** When C.T. White collected the plant in September he noted that it was just past flowering; however, closer examination found that there were remains of the corolla on some of the flowers.

**Notes:** Regarded by White (1939) as a very distinctive species because of the thick short peduncle so that the flowers appear to be clustered in the axils of the subtending leaves. This description has been compiled from an examination of the type specimen



**Fig. 6.** Holotype specimen of *Ardisia fasciculata* (White 10673 [BRI]).

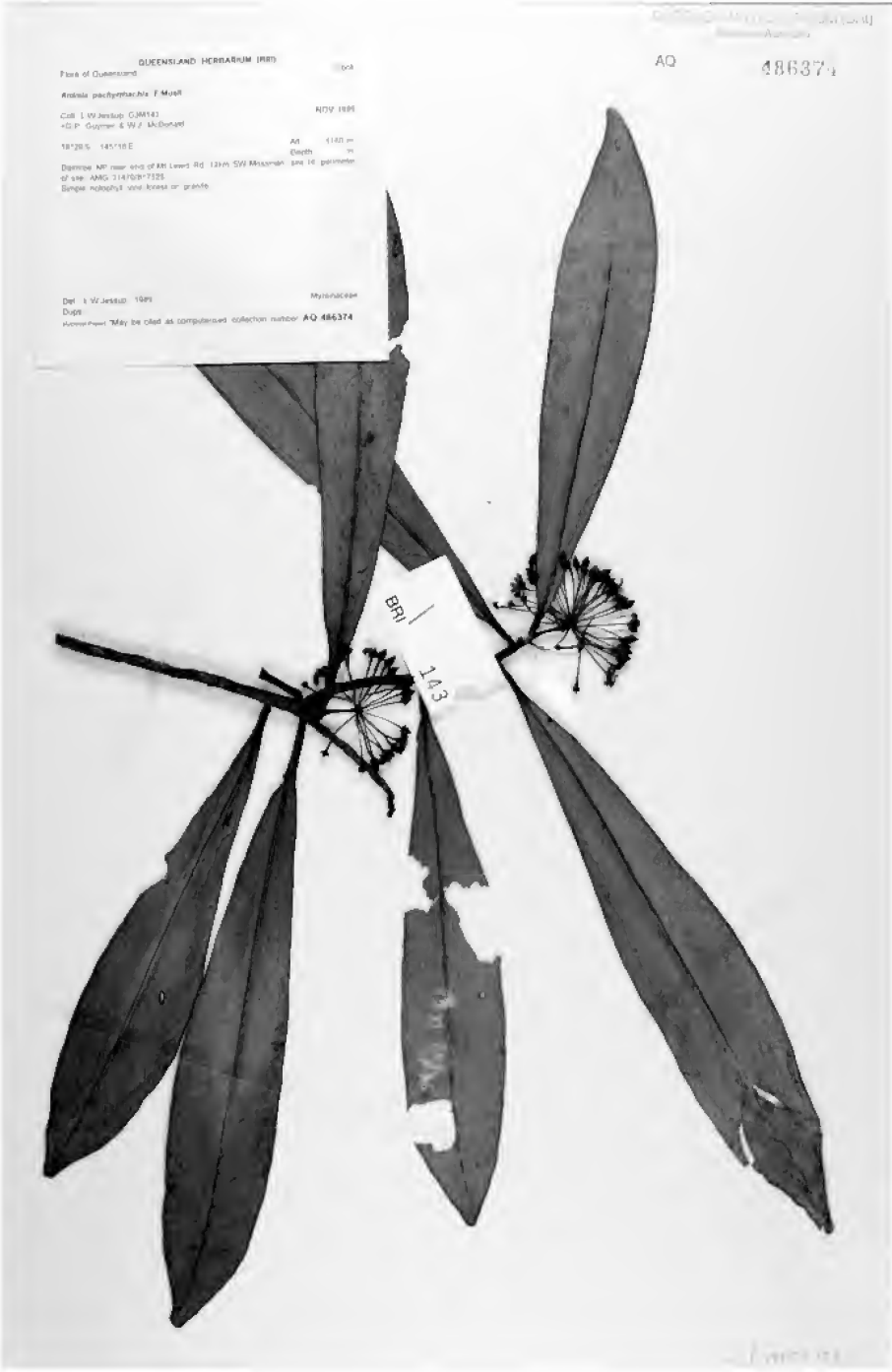


Fig. 7. Representative specimen of *Ardisia pachyrrhachis* (Jessup, Guymer & McDonald GJM143 [BRI]).

combined with the original description and notes by C.T.White. Details of the style were unavailable because of the nature of the specimen. It is the only species seen where the corolla lobes are shorter than the tube, its taxonomic position thus remains unclear until additional fertile material is obtained. It differs from both *Ardisia brevipedata* and *A. pachyrrhachis* in the number of ovules and the short thickened peduncle and pedicels, as well as the corolla lobes much shorter than the tube.

**Etymology:** From the Latin *fasciculus* – fascicle or cluster and refers to the flowers being clustered in the axils of the subtending leaf.

**7. *Ardisia pachyrrhachis* (F.Muell.) F.M. Bailey, *Botany Bull., Dept. Agric. Queensland* 3: 14 (1891). *Bladhia pachyrrhachis* F.Muell., *Vict. Nat.* 8: 15 (1891). **Type:** Queensland. COOK DISTRICT: In the upper region of Mount Bartle Frere, January 1891, *S.Johnson s.n.* (lecto: MEL1612575 [here chosen]; isolecto: BRI [AQ23416], K, MEL1612573; *P n.v.*).**

**Illustration:** Cooper & Cooper (2004: 335).

Shrub or small tree, 1–5(–7) m tall, sparsely branched; bark smooth; branchlets angular, reddish-purple when young, scars obvious. Leaves alternate, petiolate; petiole (2–)5–10 mm long, purplish-red, marginate, flat on adaxial surface. Lamina coriaceous, obovate, 7.7–28.5 cm long, (1.7–)2.3–8.3 cm wide, adaxial surface dull green, abaxial surface paler, glabrous except for scattered scales; apex obtuse to acuminate, base cuneate, margins smooth, usually recurved, midrib depressed on adaxial surface, raised on abaxial surface, purplish-red in colour when fresh, lateral veins relatively inconspicuous particularly when fresh, more than 20 per side; glands in reflected light, pellucid when fresh, red on oxidation, externally appearing black when dry, irregularly globular to lineate, with a length:breadth ratio up to 50:1. Inflorescence axillary, racemose to subumbellate or umbellate, to 4 cm long; peduncles thick, 5–11 mm long, (1–)2–5 mm wide, reddish; rhachis 2–10 mm long, flowers (10–)19–44 per inflorescence; pedicels filiform, often curved, reddish 10–23 mm

long, glands appearing black; subtending bracts soon caducous, to 10 mm long and 4 mm wide, scars persistent, glands shortly lineate, appearing black. Flowers 5-merous, 4–5 mm long. Calyx 5-lobed; tube 0.2–0.3 mm long, lobes broadly triangular to broadly ovate, 0.75–1 × 1–1.5 mm, spreading after anthesis, margins scarious, glands dense, dark red to black, but near margin they are often small, globular and orange-red so calyx usually appears almost black when dry but dark pink when fresh. Corolla white, cream or pale pink; tube c. 0.5 (–1.5) mm long; lobes twisted in bud, spreading after anthesis to 3.5–4 mm long, c. 1.5 mm wide, apex reflexed, margins scarious, inner surface with scattered uniseriate ferruginous hairs, glands dark red, irregularly globular to shortly lineate. Stamens opposite the petals, connivent around the style; base of filaments fused to form a rim fused to corolla-tube, uniseriate ferruginous hairs dense on rim, free portion of filament to c. 0.3 mm long; anthers cordate-sagittate, c. 2 mm long, 1–1.5 mm wide at base, glands absent, apex apiculate. Ovary globose, c. 1.5 mm diameter, tapering into style, pink when fresh. Style usually twisted, 2–3 mm long, pink, glands dark, stigma punctiform. Ovules uniseriate, 4, embedded in placenta. Fruit globular to depressed-globular, 5–8 mm diameter, bright red at maturity, style persistent, glands shortly lineate dark-coloured. Seed depressed-globular, 4–5 × 6 mm, testa brown. *mountain Ardisia*. **Fig. 7.**

**Additional selected specimens (from c. 107 examined):**

**Queensland.** COOK DISTRICT: Upper Parrot Creek, Annan River, Sep 1948, *Brass 20239* (BRI, CANB); Gap Creek, c. 38 km S of Cooktown (9 km by road from Rossville), Sep 1960, *Smith 11231* (BRI); T.R. 146, Tableland L.A., Sep 1980, *Hyland 10583* (CNS); Mt Misery on Mt Carbine Tableland, Sep 1972, *Webb & Tracey 10823* (BRI, K); Mt Hemmant just N of Noah Creek in Cape Tribulation area, Jul 1973, *Webb & Tracey 11726* (BRI); S.F.R. 144 Whypalla, Bowerbird L.A., Feb 1988, *Hyland 13506* (CNS); S.F.R. 144, Western edge of Windsor Tableland, Nov 1971, *Dockrill 301* (BRI, CNS); S.F.R. 143 Kanawarra, Carbine T.R., May 1995, *Gray 5936* (CNS); Daintree N.P., near end of Mt Lewis road, 12 km SW of Mossman, Nov 1988, *Jessup GJM143 et al.* (BRI); Mt Lewis road, 28–29 km from Rex Highway, Aug 1986, *Weston 602 et al.* (BRI, NSW); 8 km along Mt Lewis road from the junction with Mareeba to Mossman road, Oct 1987, *Foreman 1676* (AD, BRI, CANB, CNS, MEL, NSW); T.R. 66, Mt Lewis, Sep 1978, *Moriarty 2465* (BRI, CNS); Murray Prior Range, tributary of Hills Creek,

Dec 1990, *Lyons 87* (BRI); *ibid*, *Lyons 88* (JCT); North Bell Peak, upper western slopes, Malbon Thompson Range, Jun 1996, *Forster PIF18014 et al.* (BRI, CNS); Wooroonooran N.P., Mt Bellenden Ker summit, Dec 2001, *Forster PIF27938 et al.* (BRI); Boonjee L.A., near Bartle Frere track S of Bobbin Bobbin Falls, 5.4 km NE Boonjee, Oct 1988, *Jessup GJM338 et al.* (BRI); Babinda Creek, Oct 2000, *Jago 1255* (CNS); Mt Bartle Frere, South Peak, Mar 1997, *Gray 7130* (CNS); Russell River, 1892, *Johnson s.n.* (MEL1612571); Mourilyan Harbour, Feb 1890, *Bailey s.n.* (BRI [AQ91568]).

**Distribution and habitat:** Rainforest understory shrub or small tree, found from south of Cooktown (15°30'S) to the Mt Bartle Frere and Innisfail area south of Cairns (17°30'S) (**Map 6**). Altitude from sea-level to 1500 m although most collections have been made above 400 m altitude.

**Phenology:** Neither flowers nor fruits have been collected from May to July inclusive.

**Notes:** This species is similar to *Ardisia brevipedata* but can be distinguished by the adaxial surface being dull rather than a glossy green; the robust inflorescence and the flowers usually more numerous, (in *A. pachyrrhachis* (10–)19–45 versus 12–25 in *A. brevipedata*).

Foliicolous lichens are common on the adaxial surface of the older leaves and leafy liverworts are also often present.

**Etymology:** The specific epithet refers to the thick peduncle of the inflorescence and is derived from the Greek *pachys* - thick or stout, and *rach*- main axis.

**8. *Ardisia sanguinolenta*** Blume, *Bijdr.* 685 (1826). **Type:** Java. *s.dat.*, *Blume s.n.* (holo: L900.211-170).

*Ardisia colorata* Roxb., *Fl. Ind.* ed. Carey, 2: 271 (1824), *nom. illeg. non* Link (1821). **Type:** Illustration, W. Roxburgh *Icon.* No. 2126 (K).

**Illustrations:** Du Puy (1993: 180, figs. 41F–H), Claussen (2005: 63), all as *A. colorata*.

**Notes:** This species has been known as *Ardisia colorata* for over 170 years (e.g. Larsen & Hu 1996). Recently these authors established that *A. sanguinolenta* Blume was the correct name for this species and that *A. colorata* should be placed in synonymy (Larsen & Hu 2001).

This variable species is found on Christmas Island and is distributed from

India and southern China east to Java. The Christmas Island specimens of this species can be distinguished from Asian material by the young stems being slightly winged. A description of this species may be found in Du Puy (1993) as *A. colorata*.

### Taxonomy of *Tetrardisia*

*Tetrardisia* was erected by Mez (1902) to accommodate a single species (*Ardisia denticulata* Blume) which had 4-merous flowers and less than 10 ovules. Stone (1989) considered *Tetrardisia* to be a valid genus with three species distributed from the Malay Peninsula through Borneo and Java. These species, *Tetrardisia corneri* Furtado, *T. porosa* (C.B. Clarke) Furtado, and *T. tetrasepala* (King & Gamble) Furtado, together with *T. denticulata* (Blume) Mez are all 4-merous and have 6 or 7 ovules in one series. Larsen & Hu (1995) placed *Tetrardisia* in synonymy under *Ardisia* but at the rank of subgenus. Ståhl & Anderberg (2004) again recognized *Tetrardisia* as a valid genus. However, neither Stone (1992) nor Larsen & Hu (1995) mentioned the Australian taxon described as *Tetrardisia disticha* by Domin (1928) and which is synonymous with *Tetrardisia bifaria*.

Thus, currently after including a species from Thailand described by Larsen & Hu (1991) as *A. tetramera* Larsen & Hu, there are at least six species in this genus. Another species with 4-merous, unisexual flowers described by Stone (1982) as *Tetrardisia fruticosa* B.C. Stone, was subsequently transferred by him to *Systellantha* B.C. Stone (Stone 1992).

***Tetrardisia*** Mez in Engler, *Pflanzenr.* 9(IV.236): 189 (1902); *Ardisia* subgenus *Tetrardisia* (Mez) K. Larsen & C. M. Hu, *Nord. J. Bot.* 15: 162 (1995). **Type:** *Tetrardisia denticulata* (Blume) Mez. (syn: *Ardisia denticulata* Blume).

Shrubs or small trees to 3 m tall, often slender. Leaves sessile, subsessile to petiolate (non-Australian); lamina usually elliptic to lanceolate; margins crenate, serrulate or more or less entire, abaxial surface glabrous or pubescent; glands dark-coloured, chiefly

globular. Inflorescences axillary or terminal racemes or panicles (non-Australian) with 4–20 flowers per inflorescence. Flowers bisexual, 4-merous; pedicels thin, papillate, reddish glands usually associated with all parts; calyx free or fused at base, margins often papillate; corolla rotate, white to pink, shortly fused at base, lobes imbricate in bud overlapping to the right. Stamens free or inserted near the base; filaments very short; anthers sagittate, introrse, 2-locular, opening by longitudinal slits. Ovary superior, globose to subglobose; style filiform more than twice length of ovary, stigma punctiform. Ovules few, embedded in placenta, 2–4-seriate in a single level. Fruit a drupe, globose; seed 1.

**Etymology:** From Greek *tetra* - four and *Ardisia* the genus, referring to the 4-merous flowers.

**Tetrardisia bifaria** (C.T.White & W.D.Francis) C.T.White, *Bull. Misc. Information Kew* 45 (1933); *Ardisia bifaria* C.T.White & W.D.Francis, *Proc. Roy. Soc. Queensland* 35: 73 (1924). **Type:** Queensland. COOK DISTRICT: Bellenden Ker, March 1922, *C.T.White 1308* (holo: BRI [AQ23413]; iso: K).

*Tetrardisia disticha* Domin, *Biblioth. Bot.* 89: 504 (1928). **Type:** Queensland. COOK DISTRICT: Bellenden Ker, December 1909, *K.Domin s.n.* (PR *n.v.*).

**Illustration:** Cooper & Cooper (2004: 334).

Erect understory shrubs to 2 m tall, although usually much shorter, much-branched, subverticillate; branchlets terete, weakly zig-zag, glandular papillae and sessile glandular, reddish scales present, very small leaves common near base of branchlets, young growth pink. Leaves distichous, sessile to subsessile; petiole absent or minute, if present often papillate; lamina chartaceous to coriaceous, oblong-lanceolate to obsubulate, (0.6–)3–10.5 cm long, (0.3–)1–1.9 cm wide, often somewhat asymmetrical, adaxial surface dull green, glabrous abaxial surface paler with scattered, reddish glandular scales; apex acuminate to obtuse, base cordate and clasping the stem, margins entire or occasionally some minute teeth present, often reddish when fresh; midrib deeply depressed on adaxial surface,

prominently raised on abaxial surface, reddish, glandular papillae sometimes present particularly towards the base; lateral veins inconspicuous looping towards the margin but not forming a continuous marginal vein, number varies with length of leaf, usually from between 16 to 30 on either side of the midrib; glands irregularly globular, reddish, randomly distributed, may be visible as bumps on the adaxial surface. Inflorescence an axillary raceme *c.* 1.5 cm long, flowers 4–8, peduncle 0.8–2 mm long, reddish; pedicels often appear to arise from almost the same point, pedicels filiform, 4–8 mm long, reddish, glandular papillae may be present; subtending bracts chartaceous, oblong, soon caducous 1–2 mm long, 0.5–1 mm wide at base, glands not observed. Flowers *c.* 3 mm long. Calyx green; tube 0.5–0.75 mm long, lobes triangular, *c.* 1.5 mm long, 0.2–0.5 mm wide at base, glands few, irregularly globular, red. Corolla green to white; corolla-tube *c.* 0.2 mm long; lobes widely spreading after anthesis, *c.* 3 mm long and 2 mm wide at base, margins inflexed towards the apex, uniseriate pale-coloured hairs present at junction of tube and lobes; glands shortly lineate light to dark red in median area only. Stamens antepetalous, base of filaments fused to form a very short rim, free portion subsessile, flattened, 0.1–0.3 mm long; anthers cordate at base, tapering into a short point, 1.75–2 mm long, 1–1.5 mm wide at base, connective reddish, no glands observed. Ovary 0.75–1 mm diameter, tapering into the style, glands red; style 2–3 mm long twisted, stigma glands if present red. Ovules uniseriate, 2–4. Fruit 5–6 × 6 mm, bright red at maturity, endocarp ribbed; glands globular to lineate dark red. Seed globular, *c.* 5 mm diameter, testa brown. *miniature spearflower*. **Fig 8.**

**Additional selected specimens (from *c.* 42 examined):** **Queensland.** COOK DISTRICT: S.F.R. 310, upper Goldsborough L.A., 17 km SE of Mulgrave township, Site 34, Nov 1988, *Jessup GJM1831 et al.* (BRI); S.F.R. 310, Nov 1992, *Irvine 2352* (CNS); The Boulders, Babinda, Jun 1999, *Gray 7574* (CNS); The Boulders, Babinda, Jun 1997, *Jago 651* (CNS); Start of Bartle Frere walking track, Dec 2001, *Booth 2789 & Jensen* (A, BRI, MEL); T.R. 1230, Wonaroo Creek catchment, upper Russell River, 1972, *Tracey 15497* (BRI, DNA, LAE, PNH); Westcott Road, Topaz, Jan 1996, *Cooper 960 & Cooper* (CNS); Wooroonooran N.P., Tableland section near zig-zag, Oct 2000, *Forster PIF26309 et al.* (BRI); S.F.R. 755,

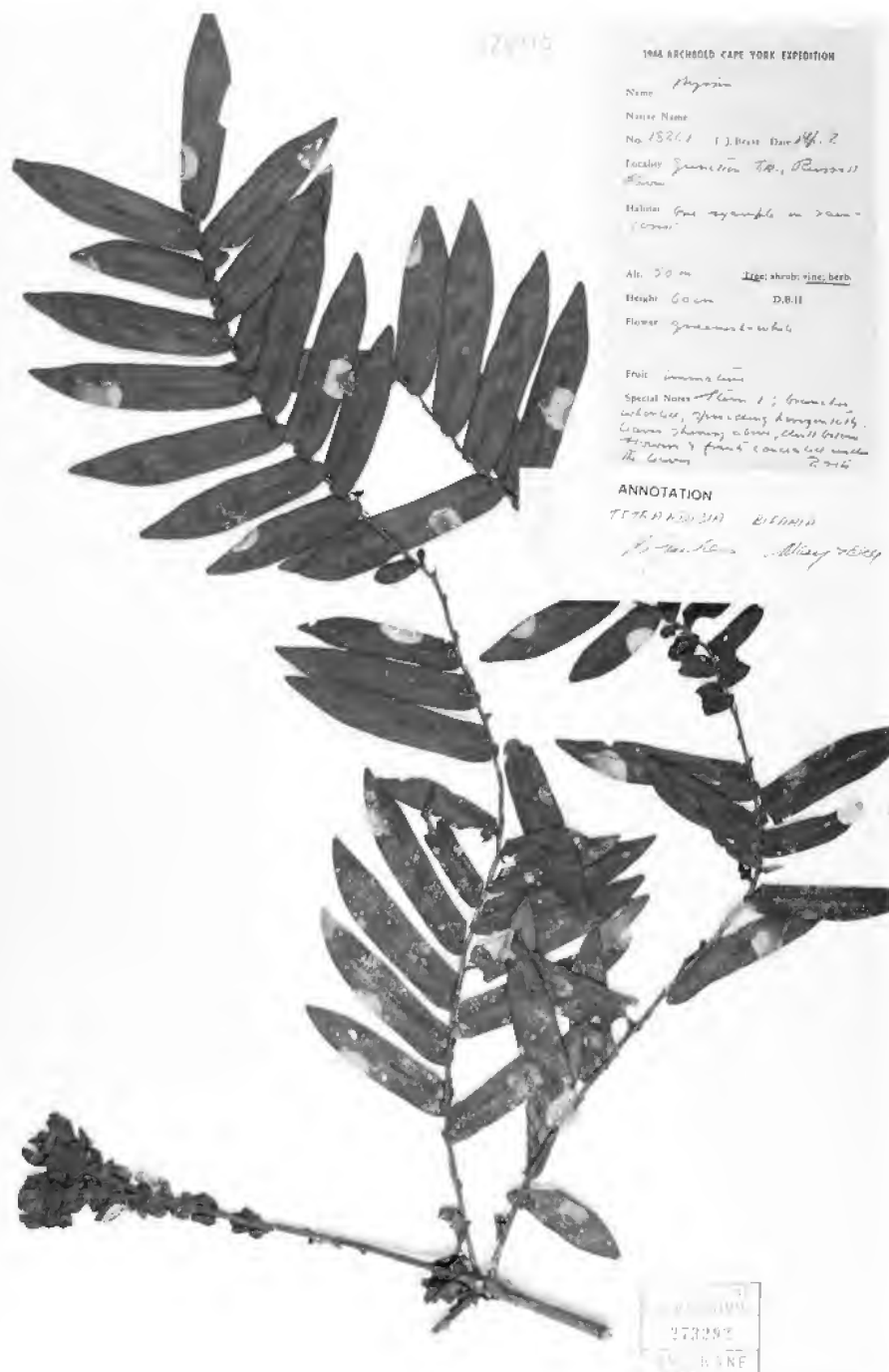


Fig. 8. Representative specimen of *Tetrardisia bifaria* (Brass 18261 [BRI]).

Gosschalk L.A., Mar 1995, *Gray 6020* (CNS); S.F.R. 755 Bartle Frere, Gosschalk L.A., Nov 1991, *Hyland 14340* (BRI, CNS); Near Topaz, Feb 1990, *Nicholson s.n.* (CNS 93290); N.P. 226, Bartle Frere zig-zag track from Russell River to Towalla, 250 m from river, Sep 1993, *Bostock 1467 & Turpin*, (BRI); Junction track, Russell River, Apr 1948, *Brass 18261* (BRI).

**Distribution and habitat:** Most collections have been made in rainforest associated with Mt Bartle Frere and Mt Bellenden Ker at altitudes above 600 m. However, several specimens of *Tetrardisia bifaria* have been collected at lower altitudes such as at The Boulders, Babinda (alt. 40 m) and at 220 m in the upper Goldsborough Valley. Although this species has a restricted distribution it chiefly occurs within protected areas (**Map 7**).

**Phenology:** Flowers have been collected from August to April with a peak occurring in January and February. Fruits recorded from April to November but mature fruits have been chiefly observed in September and October.

**Notes:** The species is readily distinguished from the Australian *Ardisia* species by the 4-merous flowers and the sessile or subsessile, 2-ranked leaves where the cordate lobes of the leaf base appear to clasp the stem. The flowers and fruits are often difficult to see as they are concealed under the leaves.

**Etymology:** The specific epithet is from the Latin *bi-* two and *-farius* –ranked, referring to the leaves being two ranked.

### Excluded names

*Ardisia pseudojambosa* F.Muell., *Fragm.* 4: 81 (1864) [= *Tapeinosperma pseudojambosa* (F.Muell.) Mez, *fide* Jackes (2005)].

*Ardisia repandula* F.Muell., *Fragm.* 4: 82 (1864) [= *Tapeinosperma repandulum* (F.Muell.) Jackes, *fide* Jackes (2005)].

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**Map 1**



*Ardisia bakeri*

**Map 2**



*Ardisia brevipedata*

**Map 3**



*Ardisia crenata*

**Map 4**



*Ardisia depauperata*

**Map 5**



*Ardisia elliptica*

**Map 6**



*Ardisia pachyrrhachis*

**Map 7**



*Tetrardisia bifaria*



# Taxonomic and nomenclatural notes on the Eastern grey boxes (*Eucalyptus* ser. *Moluccanae* Chippendale, Myrtaceae) and the reinstatement of *Eucalyptus woollsiana* R.T.Baker

A.R. Bean

## Summary

Bean, A.R. (2009). Taxonomic and nomenclatural notes on the Eastern grey boxes (*Eucalyptus* ser. *Moluccanae* Chippendale, Myrtaceae) and the reinstatement of *Eucalyptus woollsiana* R.T.Baker. *Austrobaileya* 8(1): 25–34. Four species are recognised in the Eastern grey box group, *E. moluccana* Roxb., *E. albens* Benth., *E. woollsiana* R.T.Baker and *E. microcarpa* (Maiden) Maiden. *E. pilligaensis* is reduced to synonymy under *E. woollsiana*. The taxonomic status of *E. microcarpa* is discussed. The nomenclature of *E. woollsiana* is discussed and lectotypes are selected for *E. woollsiana* and *E. albens*. Distribution maps and a key to species are provided.

Key Words: Myrtaceae, *Eucalyptus*, *Eucalyptus albens*, *Eucalyptus microcarpa*, *Eucalyptus moluccana*, *Eucalyptus pilligaensis*, *Eucalyptus woollsiana*, Australia, Australian flora, taxonomy, nomenclature, identification keys

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## Introduction

The Eastern grey box group (*Eucalyptus* ser. *Moluccanae*) was established by Chippendale (1988), who included four species, viz. *E. moluccana* Roxb., *E. microcarpa* (Maiden) Maiden, *E. albens* Benth. and *E. pilligaensis* Maiden. These species are commonly referred to as the “Eastern grey boxes” or the “Grey boxes”. This group is defined by the grey scaly box-bark persistent on the trunk and sometimes on larger branches; deciduous bark shedding in long ribbons; the adnate anthers; the presence of two opercula, both held until maturity (and hence operculum scar absent); mature buds with one or more longitudinal ridges, sometimes extending to the operculum; stamens all fertile; the fruits often slightly or distinctly barrel-shaped, i.e. broadest below the distal end of the fruit; and the fruiting valves deeply enclosed.

Brooker (2000) altered the rank and circumscription of the group. His *Eucalyptus* supraspecies *Moluccanae* (Chippendale) Brooker included nine species, viz. *E. moluccana*, *E. microcarpa*, *E. pilligaensis*, *E. albens*, *E. polybractea* R.T.Baker, *E. odorata* Behr, *E. viridis* R.T.Baker, *E. persistens* L.A.S.Johnson

& K.D.Hill and *E. lansdowneana* subsp. *albopurpurea* Boomsa (now *E. albopurpurea* (Boomsa) D.Nicolle). The recently named *Eucalyptus castrensis* K.D.Hill (Hill & Stanberg 2002) and *E. aenea* K.D.Hill (Hill 1997) could reasonably be added to this group.

This paper deals with the four species of ser. *Moluccanae* of Chippendale (1988). These are the only species known as the “Eastern grey boxes”. With the exception of *Eucalyptus odorata*, the other species included by Brooker (2000) are either mallees or are geographically disjunct from occurrences of Eastern grey boxes.

**Clinal variation in eucalypts:** There are a great number of *Eucalyptus* species that are relatively uniform and can always be distinguished from their relatives, e.g. *E. tenuipes* (Maiden & Blakely) Blakely & C.T.White, *E. longifolia* Link, *E. robusta* Sm. While identification of these species may not always be easy, they do not appear to intergrade with any other species.

However, eucalyptologists have long acknowledged that for other species there is extensive intergradation or clinal variation within and between them. For instance,

*Eucalyptus populnea* F.Muell. and *E. brownii* Maiden & Cabbage intergrade extensively in central Queensland (Pedley 1969), and identification in the overlap zone is achieved by applying arbitrary rules such as the length-breadth ratio of adult leaves. *Eucalyptus saligna* and *E. botryoides* intergrade south of Sydney (Passioura & Ash 1993) and a number of species pairs in the eastern Red gum group (*Eucalyptus* subser. *Erythroxyla*) intergrade extensively (Brooker & Slee 2000).

For the Eastern grey box group, numerous botanists e.g. Maiden (1921), Blakely (1934), Pryor & Johnson (1971), Gillison (1976), Hill (1991), Brooker & Slee (1996), Brooker & Kleinig (2006), Nicolle (2006) have acknowledged that there is intergradation or clinal variation between its member species. The PhD thesis of Gillison (1976) was an attempt to classify the Eastern Grey box taxa using numerical taxonomic techniques. He proposed a number of subspecies for *E. moluccana*, but these were never validly published.

The range of variation exhibited by this group is too great for the recognition of only one species, but when four species are recognised (as is currently the case), the species are very difficult to define and consistently identify. Previous reported differences between species have often been vague. For instance, Brooker *et al.* (1984) said that *Eucalyptus moluccana* “differs from the other Grey boxes *E. microcarpa* and *E. pilligaensis* in the broader leaves, usually less rough bark and taller habit”. Hill (1991) keyed *Eucalyptus moluccana* from *E. microcarpa* by the bud length (not borne out in the descriptions) and the width of the adult leaves.

My field investigations have clearly indicated that there is clinal variation within and across all taxa, at least in some parts of their range. On the other hand, there are clear and distinct morphological changes in some areas.

In view of the poorly defined differences between taxa and the intergradation between them, one could argue that three species only (*Eucalyptus moluccana*, *E. albens* and *E. woollsiana*) should be recognised, with the

typical form of *E. microcarpa* being merged with *E. moluccana*, and the southern New South Wales, Victorian and South Australian populations of *E. microcarpa* included with either *E. woollsiana* or *E. odorata*. However, I have maintained the status quo for *Eucalyptus microcarpa* here because of my lack of field knowledge of the group in Victoria and South Australia.

As with many other groups within *Eucalyptus*, the identification to species of herbarium specimens of Eastern grey boxes can be difficult. The juvenile leaves, so useful in the classification of *Eucalyptus* spp., are only rarely represented in herbarium material. It therefore falls to field observations or seedling trials to gather information on the juvenile leaf morphology.

### Materials and methods

The data and descriptions presented here are based largely on a morphological study of herbarium specimens at BRI and NSW, as well as type material at K and MEL. This has been supported by extensive field examinations of Eastern grey box populations by the author throughout much of Queensland and New South Wales over the last twenty years. All measurements are based on dried herbarium specimens.

### Taxonomy

***Eucalyptus* series *Moluccanae*** Chippendale, *Fl. Australia* 19: 501 (1988). **Type:** *E. moluccana* Roxb.

Trees, single-trunked. Persistent bark scaly or finely tessellated, uniformly grey or mottled with various shades of grey; deciduous bark grey, white, yellow or coppery, somewhat shiny, shedding in long ribbons. Terminal panicle inflorescences and axillary simple inflorescences often both present. Mature buds with one or more longitudinal ridges, sometimes extending to the opercula. Opercula two, both shedding at anthesis, operculum scar absent. Stamens all fertile; filaments white, inflexed; anthers adnate. Fruits with deeply enclosed valves.

## Key to species of the Eastern grey box group

- 1 Fruits cupular to obconical, 2.3–4.2 mm long; juvenile leaves linear to lanceolate (5–20 times longer than broad); adult leaves 5.5–15 times longer than broad . . . . . **1. *E. woollsiana***
1. Fruits slightly to distinctly barrel-shaped, sometimes cupular, (3–)4–13 mm long; juvenile leaves ovate to orbicular (1.4–5 times longer than wide); adult leaves 2.9–6.8 times longer than broad. . . . . **2**
- 2 Buds, fruits and branchlets glaucous; fruits 8–13 mm long . . . . . **2. *E. albens***
2. Buds, fruits and branchlets not glaucous; fruits (3–)4–7.5 mm long. . . . . **3**
- 3 Juvenile leaves broadly-ovate to almost orbicular, 1.4–2.8 times longer than broad; fruits 4–7.5 × 3.5–6 mm; adult leaves 2.1–5(–6) cm wide . . . . . **3. *E. moluccana***
3. Juvenile leaves ovate to broadly lanceolate, 2.5–5 times longer than broad; fruits (3–)4–6.5 × 3–5.5 mm; adult leaves 1.4–3.4 cm wide . . . . . **4. *E. microcarpa***

**1. *Eucalyptus woollsiana*** R.T.Baker, *Proc. Linn. Soc. New South Wales* 25: 684 (1900, publ. 1901). **Type citation:** “Girilambone, Cobar, and Trangie (W. Baeuerlen); Nyngan and Murga (R. H. Cambage)”. **Type:** New South Wales. Nyngan, June 1900, *R.H.Cambage s.n.* (lecto [here designated]: NSW321382).

*Eucalyptus odorata* var. *woollsiana* Maiden, *Crit. Revis. Eucalyptus* 2: 32 (1910). **Types:** Mount Boppy, near Cobar, *J.L.Boorman*; Girilambone to Condobolin, *W.Baeuerlen*; Condobolin, *R.H.Cambage*; Gilgandra, *R.H.Cambage*; on the plains near Baradine, *W.Forsyth*; 18 miles from Dubbo, *W.Forsyth*; Castlereagh River, *W.Woolls*; Narrabri, *J.H.Maiden*; Narrabri West, *J.L.Boorman*; Pilliga, *J.L.Boorman*; Denman, *W.Heron* (all syn: NSW).

*Eucalyptus pilligaensis* Maiden, *J. & Proc. Roy. Soc. New South Wales* 54: 163 (1920), **syn. nov.** **Type:** New South Wales. Narrabri, November 1899, *J.H.Maiden s.n.* (holo: NSW [2 sheets; NSW322074 & NSW322075]).

**Illustrations:** Brooker & Kleinig (2004: 323), as *E. pilligaensis*; Brooker & Kleinig (2006: 221), as *E. pilligaensis*.

Bark persistent on trunk to base of primary branches, mid- to dark-grey, smooth bark grey to yellow or coppery. Juvenile leaves linear to broadly-lanceolate, dull but not glaucous, 8.5–13 × 0.7–2.5 cm, 5–15 times longer than broad. Adult leaves narrow-lanceolate to

lanceolate, ± glossy, 9–13 × 0.8–2 cm, 5.5–15 times longer than wide, straight or slightly falcate. Inflorescence 5–7-flowered, axillary or in short panicles. Peduncles 2–7 mm long, ± terete. Pedicel angular, 1.5–5 mm long, angles extending to base of hypanthium and sometimes onto operculum. Mature buds broadly ellipsoid, not glaucous, 3.3–5.5 mm long, 2–2.6 mm wide. Operculum conical, about same length as hypanthium, acute. Fruiting pedicel 1–3.5 mm long. Fruits cupular, not glaucous, 2.3–4.2 mm long, 2.7–3.6 mm wide, disc descending, valves 3 or 4.

**Additional selected specimens examined: Queensland.** MARANO DISTRICT: 11 km NE of Mt Owen Homestead, c. 140 km N of Mitchell, Nov 2006, *Bean 25849* (BRI); 25 miles [40 km] from Ogilby corner towards Womblebank, Apr 1975, *Brooker B4889* (BRI). DARLING DOWNS DISTRICT: c. 7.4 km W on Mt Myrtle road from Miles – Wandoan road (Leichhardt Highway), Oct 1993, *Slee 3466* (BRI, CANB); 21 miles [34 km] ENE of Chinchilla, Jun 1968, *Johnston 585* (BRI, CANB); Yuleba S.F., 46 km by road W of Condamine and c. 14 km S of Condamine Highway, Apr 2004, *Thomas 2598* (BRI); Coomrith Station near Meandarra, Jul 1969, *Webb 8303* (BRI); Mingimarny S.F. 131, 20 km S of Milmerran, Apr 1995, *Forster PIF16450* (BRI); Bracker S.F., Catfish Creek (south branch), 5 km due W of Texas – Inglewood road, Oct 1994, *Sparshott KMS343* (BRI); 1 km E of Kurumbul, Feb 1996, *Bean 9825* (BRI). **New South Wales.** NORTH WESTERN PLAINS: c. 30 km SE of Boggabilla, May 1986, *King 32* (NSW); adjacent to “Currotha” Homestead, c. 80 km W of Moree, Jan 1999, *Wannan 1056* (NSW); Cuttabri, Aug 1919, *Jensen s.n.* (NSW); between Narrabri and Wee Waa, south of Namoi River, Feb 1964, *Walker s.n.* (NSW); 1.2 km along Cherry road, 27 km S of Narrabri, Mar 2008, *Bean 27749* (BRI, NSW); Bilambil, 9 miles [15 km] W of

Baradine, Mar 1951, *Constable s.n.* (NSW); 4.6 km E of Paisley Junction, c. 50 km SSW of Nyngan, Mar 2008, *Bean 27683* (BRI, NSW). SOUTH WESTERN PLAINS: c. 10 km NW of Five Ways, about 50 km SSW of Nyngan, Mar 2008, *Bean 27690* (BRI, CANB); 47 km S of Five Ways, towards Condobolin, Mar 2008, *Bean 27692* (BRI); 19 km from Nymagee on Condobolin road, Sep 1992, *Hill 4270* (NSW); 24.7 km NNW of Condobolin, on road to Cobar, Mar 2008, *Bean 27699* (BRI, CANB, NSW). CENTRAL WESTERN SLOPES: 9.2 km from Parkes, on road to Wellington, Mar 2008, *Bean 27704* (BRI); Wongajong, near Forbes, Aug 1904, *Holdsworth s.n.* (NSW); Ardlethan, Nov 1917, *Boorman s.n.* (NSW). SOUTH WESTERN SLOPES: SW side of Sturt Hwy at stockpile site (c. 2 km SE of Sandigo), 25.2 km SE of Narrandera, Nov 2000, *Jobson 6844* (NSW).

**Distribution and habitat:** *Eucalyptus woollsiana* is widespread from southern Queensland (e.g. Injune, Chinchilla) to southern inland New South Wales (**Map 1**). The actual southern extent is blurred by intergradation with *Eucalyptus microcarpa*. In Queensland and northern New South Wales, it frequently grows on flat land with brigalow (*Acacia harpophylla*) or belah (*Casuarina cristata*), on heavy black clay soils. Further south, it tends to grow on undulating terrain with other eucalypts, notably *Eucalyptus*

*populnea*. The soils, while still clayey, vary in colour and texture.

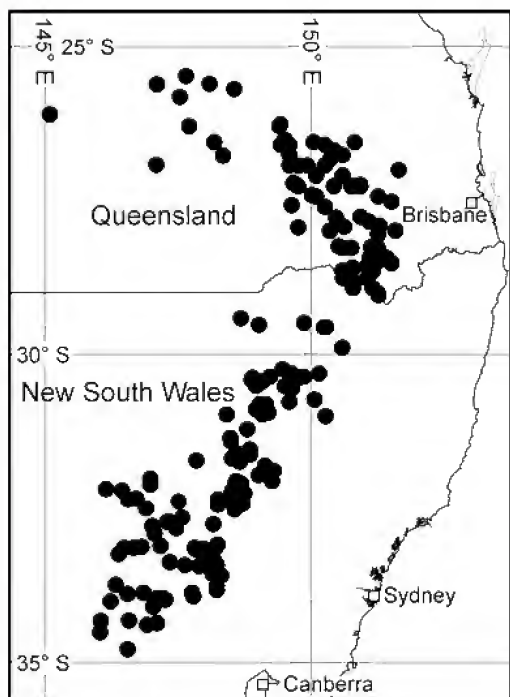
**Typification:** There has been considerable confusion about the typification and application of this name since its publication on 20<sup>th</sup> May 1901.

Maiden (1921: 202) wrote “I have received, in response to my request for types [of *E. woollsiana*], specimens labelled by Mr. Baker, Condobolin and Girilambone to Condobolin.” The two sheets mentioned by Maiden, namely “Condobolin” (NSW118270) and “Girilambone to Condobolin” (NSW118269) both belong to a taxon in the Eastern grey box group, allied to *E. moluccana* and *E. microcarpa*. Gillison (1976) and Chippendale (1988) accepted Baeuerlen’s “Girilambone to Condobolin” specimen as the type of *E. woollsiana*.

However, Article 9.10 of the International Code for Botanical Nomenclature states that the lectotype must be chosen from amongst the syntypes, if such exist. Baker’s protologue corresponds to a minimum of five specimens, some collected by W. Baeuerlen and some by R. Cambage. It is apparent that only three gatherings matching the protologue details are now extant at NSW, where Baker’s herbarium is now housed. They are 1. Girilambone, March 1900, *Baeuerlen 2578*; 2. Girilambone, January 1900, *Baeuerlen s.n.*; and 3. Nyngan, June 1900, *R.H. Cambage s.n.*

Both of the Baeuerlen gatherings are referable to *Eucalyptus viridis* R.T.Baker. Only the Cambage gathering is referable to the species of tree-form with the short pedicels and lanceolate juvenile leaves. Article 9.17 of the Code states that when the syntypes comprise more than one taxon, the chosen lectotype must be in accordance with the taxon that best matches the description given in the protologue. In this case, the species of tree-form with short pedicels and lanceolate juvenile leaves is clearly the intended species. Therefore, the Cambage specimen at NSW is designated as the lectotype.

**Notes:** It is not surprising that Baker and later workers confused herbarium material of *Eucalyptus woollsiana* and *E. viridis*.



**Map 1.** Distribution of *Eucalyptus woollsiana*

Both species have narrow green leaves, no operculum scar, small fruits, and predominantly axillary inflorescences. In the herbarium, the typical form of *E. viridis* may be distinguished by the longer and more attenuate buds, the broader fruits, the slightly narrower adult leaves, and the longer pedicels on both buds and fruits. When juvenile leaves are present, these provide a further differentiation – those of *E. woollsiana* are lanceolate near the type locality, whereas *E. viridis* juveniles are linear. In the field, there is little likelihood of confusion; *E. woollsiana* is invariably a tree to 20 metres high. *E. viridis* is invariably a mallee to 8 m which can occur in the same general area as *E. woollsiana* (e.g. S of Nyngan), but is never associated with it.

Gillison (1976) wrote “the type locality now appears to be devoid of box trees of the type described by Baker, particularly near Girilambone where *E. viridis* is common.” He then went on to postulate that all the *E. woollsiana* trees near Girilambone had been destroyed for pit-props and railway sleepers in the early 20<sup>th</sup> century. It is true that *E. woollsiana* (as to lectotype) does not now occur in the Girilambone area, but I contend that it was never there in the first place. Baker’s citation of ‘Girilambone’ in the protologue of *E. woollsiana* is based on specimens of *E. viridis*.

Blakely (1934) and Johnston & Marryatt (1965) accepted *Eucalyptus woollsiana* as a distinct species. Hall *et al.* (1970) treated *E. woollsiana* and *E. microcarpa* on the same page, because they “are so closely related”, and distinguished them only on the shape of the juvenile and adult leaves. Pryor & Johnson (1971) foreshadowed the reduction of *E. microcarpa* to a subspecies of *E. woollsiana*, but this did not occur. Brooker & Kleinig (1983) treated *E. microcarpa* as an accepted species with the notation in brackets “includes *E. woollsiana*”. Brooker *et al.* (1984) repeated this statement. Since then, *E. woollsiana* has been relegated to synonymy with *E. microcarpa*, despite the fact that *woollsiana* is the earlier name by 20 years.

The acceptance of *Eucalyptus microcarpa* over *E. woollsiana* appears to stem from Gillison (1976) who wrote “For the present ... I cannot accept *E. woollsiana* as a valid species. The taxonomic position of the lectotype is not clear. I have examined the specimen ‘Woollsiana No. 1’ from Girilambone to Condobolin (W. Baeuerlen, Sept. 1900) which is a mixture of at least two taxonomically distinct specimens”. It is perhaps true that the branchlet at the far left hand side of that specimen belongs to another gathering or taxon, but as it is sterile, it is difficult to say. Certainly all of the fertile branchlets are from the same taxon, and are consistent with a single gathering.

Gillison (1976) rejected *Eucalyptus woollsiana* with the following statement: “The retention of *E. woollsiana* as a species can serve no useful purpose, neither is it useful to consider it as ‘geminata’ with *E. microcarpa* in view of its intergradations with other taxa, in particular *E. pilligaensis*. Under the circumstances I consider the lectotype specimen is part of a hybrid swarm.”

It is indisputable that there is clinal variation occurring between members of the Eastern grey box group, but in the Nyngan area the Grey box taxon is quite uniform in morphology. Therefore it is difficult to see how the lectotype could be interpreted as “part of a hybrid swarm”, and it is not acceptable to invalidate *Eucalyptus woollsiana* on this basis.

*Eucalyptus woollsiana* does not have the ovate juvenile leaves and the rather broad adult leaves that characterise typical *E. microcarpa*, and the fruits of *E. woollsiana* are smaller and cupular to obconical in shape. Hence they cannot be considered synonymous. However, *E. woollsiana* populations occurring near Nyngan (the type area) have all the features of *E. pilligaensis*. Maiden distinguished *E. pilligaensis* on the basis of its narrow “sucker leaves” and small fruits, but these are also the salient features of *E. woollsiana*. They are here considered synonymous. There is variation in the width of juvenile leaves within *E. woollsiana*; populations from the Yelarbon–Inglewood area of Queensland have

linear juvenile leaves, while the lanceolate juveniles seen around Narrabri (type locality of *E. pilligaensis*) are very similar to those encountered between Nyngan and Condobolin (near the type locality of *E. woollsiana*).

**2. *Eucalyptus albens* Benth., *Fl. Austral.* 3: 219 (1867); *E. hemiphloia* var. *albens* (Benth.) Maiden, *Forest Fl. New South Wales* 1: 131 (1904). **Type citation:** “NSW. Macquarie River, *A. Cunningham*; New England, ‘White Gum’, *C. Stuart*; between Alford’s and the Range, ‘Box’, *Leichhardt*. Victoria. Poor plains, between Ten-mile Creek and Broken River, ‘White Box’, *F. Mueller*”. **Type:** [New South Wales]. New England, undated, *C. Stuart* s.n. (lecto [here designated]: K000347583; islecto: MEL73265).**

**Illustrations:** Brooker & Kleinig (2004: 324); Boland *et al.* (2006: 465); Brooker & Kleinig (2006: 223).

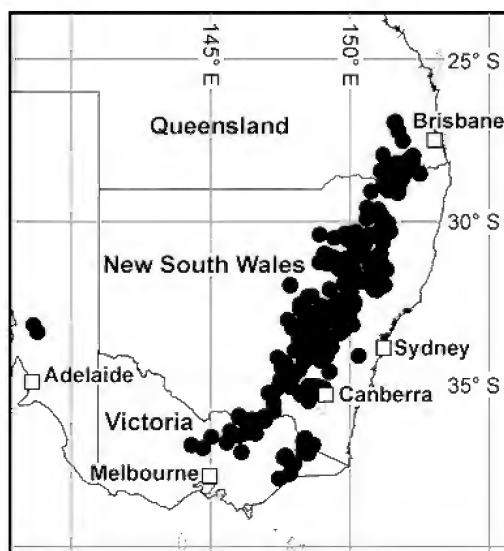
Trunk and all primary branches rough-barked, pale grey; smooth bark white to grey. Juvenile leaves broadly ovate to orbicular, glaucous, 9–15 × 4–10 cm, 1.4–2.6 times longer than broad. Adult leaves lanceolate to ovate, 7.5–15 × 1.6–3.8 cm, 3.4–8.4 times longer than wide. Umbels 7–9-flowered, young buds and pedicels very angular, mature buds with one or more longitudinal ridges, sometimes extending to the operculum, pedicels 2–5 mm long; mature buds broadly ellipsoidal, glaucous, 10–14 × 4–6 mm; operculum about same length as hypanthium; fruits barrel-shaped, glaucous, 8–13 mm long, 5.3–8 mm across, pedicels 0–13 mm long.

**Additional selected specimens examined:** **South Australia.** Along roadside to Bangor, 4.8 km S of Melrose (c. 60 km SE of Port Augusta), May 1977, *Boomsma* 235 (NSW); S of Mt Remarkable, Jan 1970, *Brown* s.n. (NSW). **Queensland.** DARLING DOWNS DISTRICT: 6.1 miles N of Yamsion on Bunya Mountains road, May 1961, *Smith* 11363 (BRI); 3.3 km E of Kulpi, towards Haden, Jul 2002, *Bean* 19085 (BRI); Maryvale, Mar 1953, *Blake* 19129 (BRI); Warwick – Inglewood road, W of Karara, Cunningham Highway, May 1994, *Grimshaw* G661 (BRI); near the summit of Mt Malakoff at the junction of Monday Creek and the Severn River, SW of Stanthorpe, Apr 1988, *Thomas* 284 (BRI). **New South Wales.** NORTH WESTERN SLOPES: Warialda, Jun 1970, *Kleinschmidt* 106 (BRI); 37.7 km from Barraba, towards Gunnedah, Dec 1995, *Bean* 9390 (BRI); Oxley Park, Tamworth, Jun 1985, *Hosking* s.n. (NSW). NORTHERN TABLELANDS: 6.2 km W of Baldersleigh, between Armidale and Bundarra,

Dec 2008, *Bean* 28406 (BRI). CENTRAL WESTERN SLOPES: 9 km NW of Cassilis along the road to Coolah, Sep 1988, *Greuter* 20615 (NSW); Merric property on ridge c. 1.5 km W of homestead, May 1988, *Hill* 2793 (BRI); 3.5 km SSE of Grenfell towards Young, Apr 1974, *Chippendale* 956 (NSW). CENTRAL TABLELANDS: Cadia, c. 24 km S of Orange, Nov 1991, *Rodd* 6248 (NSW). SOUTH WESTERN SLOPES: c. 5 km directly east of Bethungra and 31 km directly ENE of Junee, Oct 1991, *Parris* 9938 (NSW). SOUTHERN TABLELANDS: Wee Jasper Creek, Tumut, Nov 1949, *Rodway* 15094 (NSW); Jacobs Ladder, Snowy Mountains, Tongaroo River, Feb 1960, *Raeder-Roitzsch* s.n. (NSW). **Victoria.** Warby Range, 1.5 km S of Glenrowan, Apr 1985, *Briggs* 1862 (NSW); 16.2 km ESE Yarrowonga towards Rutherglen on Murray Valley Highway, Jul 1975, *Chippendale* 1394 (BRI, NSW); 1.5 miles [2.4 km] N of Ballantyne Gap towards Snowy River, Sep 1975, *Brooker* 4975 (BRI, NSW); Tongio Gap, Oct 1977, *Carr* 2220 (BRI, NSW).

**Distribution and habitat:** *Eucalyptus albens* has a limited occurrence in Queensland, confined to higher altitudes on heavy soils west of the Great Dividing Range, and south from the Bunya Mountains. It is however, very common in a broad band on the western slopes of the Great Divide in New South Wales, in northern Victoria, and near Melrose in South Australia (Map 2). It inhabits flat to undulating terrain with fertile clayey soils.

**Notes:** Johnson (1962) discussed at length the authorship of *Eucalyptus albens*, and I



Map 2. Distribution of *Eucalyptus albens*

endorse his conclusion that Bentham should be attributed as the sole author of the name.

*Eucalyptus albens* overlaps in distribution with *E. moluccana*, usually without intergradation, although Hill (1991) mentioned that it intergrades with *E. moluccana* in the upper Hunter Valley. According to Brooker & Slee (1996), *E. albens* intergrades with *E. microcarpa* in eastern and central parts of Victoria.

**Typification:** The lectotype of *Eucalyptus albens* consists of a single branchlet bearing adult leaves and several umbels of flowers. On the label is written “*Eucalyptus dealbata* A.C./ New England, N.S.W./ C. St.” The isolectotype at MEL has two branchlets bearing adult leaves, mature buds and open flowers, while there are loose mature fruits in a fragment packet.

**3. *Eucalyptus moluccana* Roxb., *Fl. Indica*, 2<sup>nd</sup> edition, 2: 2 (1832). **Type:** cultivated at Amboyna, *s.dat.*, *C. Smith s.n.* (iso: BM000944059 [image at BRI]), *fide* Johnson (1962).**

*Eucalyptus hemiphloia* F.Muell. ex Benth., *Fl. Austral.* 3: 216 (1867). **Type:** Queensland. Moreton Bay, *F. Mueller s.n.* (syn: MEL); New South Wales. Parramatta, *W. Woolls s.n.* (syn: MEL).

**Illustrations:** Brooker & Kleinig (2004: 321) and (2004: 322, as *E. microcarpa*); Boland *et al.* (2006: 461); Brooker & Kleinig (2006: 222); Melzer & Plumb (2007: 240).

Bark persistent on trunk to base of primary branches, mid- to dark-grey, smooth bark white to grey. Juvenile leaves broadly ovate to almost orbicular, dull but not glaucous, 10–15 × 3.5–10 cm, 1.4–2.8 times longer than broad. Adult leaves lanceolate to broadly-lanceolate, 8–15 × 2.1–5(–6) cm, 2.9–4.5 times longer than wide. Umbels 5–9(–11)-flowered, young buds and pedicels very angular, mature buds with one or more longitudinal ridges, sometimes extending to the operculum, pedicels 2–5 mm long; mature buds broadly ellipsoidal, not glaucous, 6–8.5(–9.5) × 3–4.5 mm; operculum about same length as hypanthium; fruits usually at least slightly barrel-shaped, occasionally cupular or obconical, not

glaucous, 4–7.5 mm long, 3.5–6 mm across, pedicels 0.5–5 mm long.

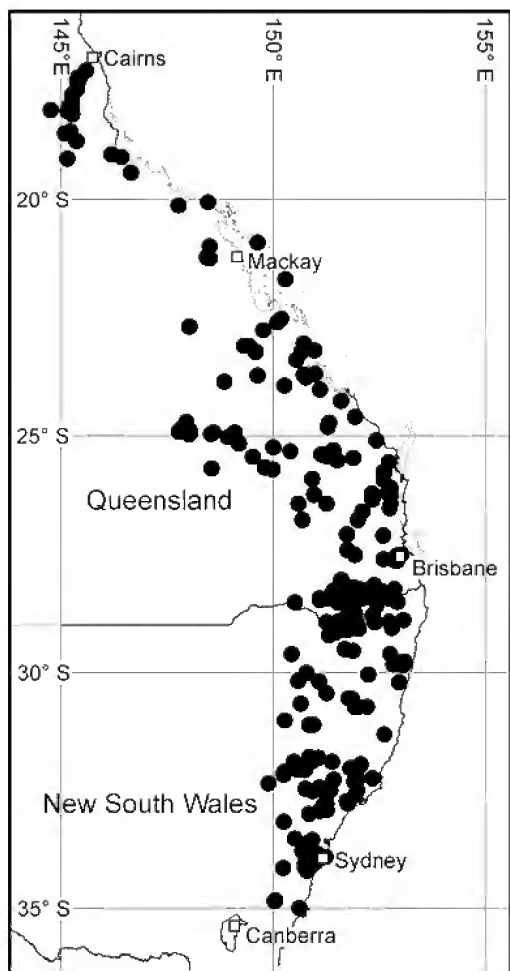
**Additional selected specimens examined: Queensland.** COOK DISTRICT: 12.5 km E of Bakerville towards Herberton, Oct 1976, *Kleinig DK315* (BRI). NORTH KENNEDY DISTRICT: 0.5 km S of Herberton on road to Wondecla, Aug 1984, *Clarkson 5483* (BRI); 10 miles [16 km] NE of ‘Valley of Lagoons’ Station, Jul 1953, *Lazarides 3761* (BRI); Near South Pinnacle, 25 km SW of Townsville, Sep 1992, *Bean 5069* (BRI). SOUTH KENNEDY DISTRICT: Scawfell Island N.P., 50 km ENE of Mackay, Nov 1986, *Batianoff 5560* (BRI, NSW); 21 km from Eungella, towards Eungella Dam, Feb 2003, *Bean 20020* (BRI, NSW). PORT CURTIS DISTRICT: 14.8 km SW of Yeppoon towards Rockhampton, Sep 1974, *Chippendale GC1122* (BRI, NSW); 37 km NW of Gladstone, S.F. 60 Rundle Range, Aug 1989, *Gibson TO1685* (BRI, NSW); 12.8 km NE of Bororen, Apr 1970, *Boylard 1515* (BRI). LEICHHARDT DISTRICT: 23.5 km E of Dingo, *Brooker 10228* (BRI, NSW); Buckland Tableland, E of Van Dyke Creek via Springsure, Apr 1988, *Bean 795* (BRI, NSW). BURNETT DISTRICT: 3 km S of Kalpowar along road to Monto, May 1977, *Crisp 2684* (BRI); 28 miles [45 km] S of Goomeri towards Nanango, Aug 1972, *Brooker 3751* (BRI). WIDE BAY DISTRICT: 3 km SSE of Tiaro on Bruce Highway, Sep 1974, *Chippendale GC1141* (BRI, NSW); Moy Pocket Road, 3 km SE of Brooloo, Apr 1993, *Bean 6004* (BRI). DARLING DOWNS DISTRICT: 15 km SSE of Leyburn, Jan 1973, *Pedley 4065* (BRI); Graymare W of Warwick, Jul 1951, *Blake 18778* (BRI, NSW). MORETON DISTRICT: North of Somerset Dam, Feb 1939, *Blake 13958* (BRI, NSW); Dinmore, Mar 1887, *Bailey s.n.* (BRI, NSW). **New South Wales.** NORTH COAST: Richmond Range at Busbys Flat and Mallangene, Dec 1920, *Rummery s.n.* (NSW); 2.1 km along Orara Way from Grafton – Nymboida road, Nov 2004, *Johnston 1443* (NSW). NORTHERN TABLELANDS: 10.4 miles [16.6 km] east of Armidale, Feb 1973, *Brooker 3907* (BRI, NSW). NORTH WESTERN SLOPES: 1 km W of Tamworth Airport, Jan 1975, *Johnson 7885* (NSW). CENTRAL WESTERN SLOPES: 18.4 km SE Murrurundi on New England Highway, Apr 1975, *Chippendale 1229* (BRI, NSW); 16.4 km from Scone towards Merriwa, Nov 1990, *Brooker 10631* (BRI, CANB, NSW). CENTRAL COAST: 6.8 km from Glenorie – Wisemans Ferry road towards Sackville, May 1974, *Chippendale 1015* (BRI, NSW); Off main Southern Road, Cabramatta, Sep 1917, *Austin s.n.* (NSW). SOUTH COAST: 1.8 km N of Klimpton on Princes Highway, between Parma and Currambene Creeks, Sep 1975, *Brooker 4926* (BRI, NSW).

**Distribution and habitat:** In New South Wales, *Eucalyptus moluccana* occurs from Port Jervis in the south, and as far west as the western slopes of the New England Tableland. In Queensland, it grows mainly within 150 km of the coast, but extends further inland around Durong, Taroom, and Duaringa. It occurs as far north as Herberton, and the most westerly occurrence is on Consuelo Tableland in the Carnarvon National Park (**Map 3**). The soils

are typically heavy clays (though sometimes sandy on the surface), and it is most often found on alluvial situations or lower slopes of hills, but sometimes on basaltic ridges.

**Notes:** The fruits borne on *Eucalyptus moluccana* around the Consuelo Tableland in central Queensland have an average length of 7.0 mm. This is much longer than elsewhere in Queensland, although comparable sizes are found on the central coast and northern tablelands of New South Wales. In other parts of Queensland, the average fruit length varies from 4.8 mm (Le, Pc, Bn districts) to 5.8 mm (Mo, Dd, Sk districts).

**Typification:** The isotype of *Eucalyptus moluccana* at BM consists of a sprig bearing



Map 3. Distribution of *Eucalyptus moluccana*

a few leaves and a few inflorescences on a second small branchlet. These inflorescences bear open flowers and a single mature bud. The combination of the apparently compound inflorescences, the leaf shape and venation, the lack of glaucousness and the bud shape provide strong evidence to support Johnson's claim that *Eucalyptus moluccana* is synonymous with *E. hemiphloia*.

**4. *Eucalyptus microcarpa* (Maiden) Maiden, Crit. Revis. *Eucalyptus* 6: 438 (1923); *E. hemiphloia* var. *microcarpa* Maiden, *Forest Fl. New South Wales* 1: 131 (1904). Type:** New South Wales. Gulgong, April 1904, J.H.Maiden & J.L.Boorman s.n. (holo: NSW).

**Illustrations:** Jones & Jones (1999: 108); Boland *et al.* (2006: 463); Brooker & Kleinig (2006: 220).

Bark persistent on trunk to base of primary branches, or sometimes rough bark extending to the medium and small branches, mid- to dark-grey; smooth bark grey to yellow or coppery. Juvenile leaves ovate to broadly lanceolate, dull but not glaucous, 9–16 × 1.8–6 cm, 2.5–5 times longer than broad. Adult leaves lanceolate to broadly-lanceolate, 7–15 × 1.4–3.4 cm, 3.3–6.8 times longer than wide. Umbels 5–7-flowered, young buds and pedicels very angular, mature buds with one or more longitudinal ridges, sometimes extending to the operculum, pedicels 2–4 mm long; mature buds broadly ellipsoidal, not glaucous, 4.5–8 × 1.8–4 mm; operculum about same length as hypanthium; fruits usually at least slightly barrel-shaped, occasionally cupular or obconical, not glaucous, (3–)4–6.5 mm long, 3–5.5 mm across, pedicels 0.5–4 mm long.

**Additional selected specimens examined:** **South Australia.** Flinders Range, Mt Remarkable foothills, Melrose, Sep 1946, *Blake* 16927 (BRI); Braeside, 18 km S of Shepherds Hill Reserve O'Halloran Hill, Oct 1968, *Boomsma* s.n. (NSW); 20 km N of Frances towards Bordertown, Mar 1995, *Brooker* 12165 (NSW). **Queensland.** MARANO DISTRICT: Mt Brandon, Apr 1936, *Blake* 11145 (BRI); 9.2 km from Mungallala towards Mitchell, Apr 1986, *Bean* 428 (BRI, NSW); 7.8 km E of Mungallala on Charleville – Mitchell road, Jul 1989, *Blaxell* 89007 (BRI, NSW); 45 km from Mitchell towards Bollon, Mar 2001, *Bean* 17545 (BRI); Murphey Creek, 3 km E of Cedarilla – Megine road, Jul 1981, *Neldner & Thomas* 383 (BRI). **New South Wales.** CENTRAL WESTERN

SLOPES: Dunedoo – Merrygoen road, Aug 1950, *Johnson s.n.* (NSW); Boomley to Caratell, Aug 1950, *Johnson s.n.* (NSW); Wollar, c. 30 miles [48km] N of Rylstone, Sep 1948, *Constable s.n.* (NSW); 23.2 km NNE of Marsden on Newell Highway, Apr 1974, *Chippendale 950* (BRI, NSW); SW of West Wyalong, Blue Mallee S.F., Apr 1992, *Sivertsen 1399* (NSW). SOUTH WESTERN SLOPES: 19.1 km NNE of Wagga Wagga on Olympic Highway, Apr 1974, *Chippendale 929* (BRI, NSW); Mooney Swamp Road, NE of Deniliquin, Aug 1992, *Porteners 20800* (NSW); between Walbundrie & Henty, Oct 1967, *Hall 29* (NSW). **Victoria.** Near Pyramid Creek, 14.3 km W of Cohuna towards Kerang, Jul 1975, *Chippendale GC1389* (BRI, NSW); NE side of Arnold Road, 7.1 km SE of Inglewood, Aug 1995, *Jobson 3695* (BRI, NSW); c. 8 km south of Benalla on Midland Highway; adjacent to Warrenbayne S.F., Aug 1994, *Brooker 11973* (NSW); 5 km W of Edenhope on Naracoorte road, Mar 1986, *Hill 1684* (NSW); Melbourne area, Melton South, 100–200 metres E from Melton Railway Station, Feb 1991, *Stajsis 174* (NSW).

**Distribution and habitat:** *Eucalyptus microcarpa*, as currently circumscribed, is widespread from the central western slopes of New South Wales (south from Dunedoo and Gulgong) and in northern, western and central Victoria and into South Australia. There is also a limited occurrence in the Mitchell area of southern Queensland (Map 4). It occurs on ranges, hills and undulating rises in clay-loam soils.

**Notes:** Maiden established *Eucalyptus hemiphloia* var. *microcarpa* as a “small-

fruited form”, but when a large number of specimens are examined there is in fact no significant difference in fruit size between specimens identified as *E. moluccana* and those identified as *E. microcarpa*.

Eastern grey box populations in the Mitchell area of southern Queensland are tentatively included here in *Eucalyptus microcarpa*, as the juvenile leaves are too broad to be accommodated by *E. woollsiana* as currently circumscribed, and the habitat for the Mitchell populations (undulating rises and residuals) is rather different to the usual habitat for *E. woollsiana* in southern Queensland (*i.e.* clay plains).

In western Victoria and South Australia, *Eucalyptus microcarpa* has rough bark extending to the medium and small branches, and is often difficult to distinguish from *E. odorata* (Nicolle 2006).

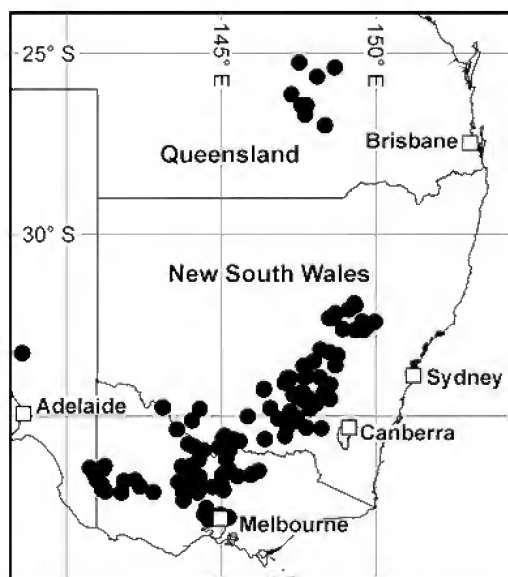
Eastern grey box populations close to the type locality of *Eucalyptus microcarpa* are very close to *E. moluccana*, apparently differing only by the somewhat narrower juvenile leaves in *E. microcarpa*. Meanwhile, populations from southern inland N.S.W. and northern Victoria are closely allied to *E. woollsiana*.

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I am grateful to Ian Brooker and Dean Nicolle for helpful discussions, and to Gordon Guymner and two anonymous referees for reviewing the manuscript. Tony Orchard (Australian Botanical Liaison Officer 2008–09) sent images of the isotype of *E. moluccana*. Peter Bostock and Will Smith prepared the distribution maps. I thank the Director of the National Herbarium of New South Wales for access to the eucalypt collections during my visit to Sydney.

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Map 4. Distribution of *Eucalyptus microcarpa*

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# Four new species of *Cyperus* L. (Cyperaceae) from northern Queensland

R.Booth, D.J.Moore & J.Hodgon

## Summary

Booth, R., Moore, D.J. & Hodgon, J. (2009). Four new species of *Cyperus* L. (Cyperaceae) from northern Queensland. *Austrobaileya* 8(1): 35–46. Four new species allied to *Cyperus pedunculatus* F.Muell., viz. *Cyperus alaticaulis* R.Booth, D.J.Moore & Hodgon, *C. eboracensis* R.Booth, D.J.Moore & Hodgon, *C. multispiceus* R.Booth, D.J.Moore & Hodgon and *C. sharpei* R.Booth, D.J.Moore & Hodgon are described and notes provided on their distribution and habitat. *Cyperus pedunculatus* is circumscribed and described. A key to this group of species is provided.

Key Words: Cyperaceae, *Cyperus*, *Cyperus alaticaulis*, *Cyperus eboracensis*, *Cyperus multispiceus*, *Cyperus pedunculatus*, *Cyperus sharpei*, Australian flora, Queensland flora, species limits, ordination, cluster analysis, identification key

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## Introduction

*Cyperus* L. *sens. lat.* includes about 700 species, the vast majority of which occur in the tropics and subtropics. There is much variation within the genus and many attempts have been made to subdivide it. These include recognizing the subdivisions at subgeneric level, or as distinct genera (Raynal 1973). Recent treatments have also taken into account the presence of C<sub>3</sub> and C<sub>4</sub> photosynthetic pathways (Bruhl 1995).

Correlating photosynthetic pathway with inflorescence structure has proven to be problematic in the delimitation of genera related to *Cyperus* and sections within *Cyperus*, at least in relation to the Australian taxa. A rigorous infrageneric classification for *Cyperus* can probably only be arrived at following extensive molecular investigation throughout the range of the genus.

Despite these classification shortcomings, some obvious groupings of taxa can be arrived at based upon similarities in both vegetative and floral morphology. In Australia, one such grouping can be based around the taxon known as *Cyperus pedunculatus* F.Muell. which has been classified in *Cyperus* section *Diffusae* C.B.Clarke (Clarke 1884, as ‘Diffusi’). Extensive field work undertaken

in recent years, throughout Queensland and particularly in the monsoonal tropics of Cape York, has resulted in the accumulation of much more material of *Cyperus* that can be allocated to this taxonomic section. Past applications of the name *Cyperus pedunculatus* are now considered to apply to several taxa, some of which are unnamed. Critical examination of this material now enables four new species to be named.

These new species show similarities in their glumes, nuts and overall spikelet characteristics to *Cyperus pedunculatus*, but differ notably in their preference for drier, fire prone habitats than those where that species occurs. Consequently their morphology may be a direct adaptation to these environmental conditions. They possess stout rhizomes or swollen, bulbous or fibrous bases. *Cyperus pedunculatus* occurs within closed forests that are not affected by fire and does not have any of these morphological features.

## Materials and methods

The 33 specimens used in the phenetic analyses as Operational Taxonomic Units (OTUs) were drawn from field-collected specimens from northern Queensland and herbarium specimens at BRI. All taxa included were represented by between four to nine OTUs (data available from the authors).

Characters (**Table 1**) were selected on the basis of an examination of the variation observed among taxa and the critical assessment of past studies. The character-state data for all OTUs were entered into a data

matrix originally prepared as a spreadsheet in Microsoft Excel 7.0. Original data collection-sheets were cross-checked with data in the spreadsheet to guard against errors.

**Table 1. List of characters used in phenetic analyses.**

Numbers refer to those in Appendix 1.

|    |                                                                            |
|----|----------------------------------------------------------------------------|
| 1  | Culm length (mm) (measured to the base of the primary inflorescence bract) |
| 2  | Culm width (mm) (measured at the mid-length of culm)                       |
| 3  | Culm cross section: (1) trigonous, (2) triquetrous                         |
| 4  | Involucral bracts - septate nodules presence: (1) absent, (2) present      |
| 5  | Primary inflorescence bract length (mm)                                    |
| 6  | Primary inflorescence bract width (mm) (at the widest part of the bract)   |
| 7  | Base of primary inflorescence bract – teeth: (1) absent, (2) present       |
| 8  | Inflorescence structure: (1) simple, (2) compound, (3) decompound          |
| 9  | Spikelet width (mm) (measured at the mid-length of the spikelet)           |
| 10 | Rachilla wing: (1) absent, (2) present                                     |
| 11 | Glume length (mm)                                                          |
| 12 | Glume mucro length (mm): (1) <0.3, (2) 0.3–0.7                             |
| 13 | Style length (mm)                                                          |
| 14 | Nut length (mm)                                                            |
| 15 | Nut width (mm) (measured at the widest part of the nut)                    |

Data was analysed using a number of numerical methods. For the phenetic analysis, the Gower distance coefficient (which includes range standardization of data) was applied to all data matrices as it handles mixed data (Crisp & Weston 1993). The unweighted pair-group method with arithmetic mean (UPGMA, with  $\beta = -0.25$ ; Belbin 1993) was used.

Ordination was performed using semi-strong-hybrid multidimensional scaling (SSH) in 2-dimensions with 200 random starts on

non weighted character states to minimise stress values. Ordinations were assessed by examining stress values and correlations of character states with ordination vectors (Belbin 1993).

Correlations between character states and ordination vectors were performed to assess which character states were contributing to the pattern of ordination. Although all character states contribute to the overall ordination pattern, correlations above 0.7 are considered diagnostic of the taxa involved (Crisp 1991).

Results and discussion

The ordination plot of the data matrix resulted in discrete groupings of OTUs representing all of the taxa included (**Fig. 1**). Eleven of the 22 character states correlated with ordination vectors >0.7 (**Table 2**) indicating that half of the characters included contributed strongly to the ordination pattern. All the groups recognised in the ordination were discrete,

but two groups of OTUs were relatively loosely clustered (e.g. *Cyperus alaticaulis* and *C. multispiceus*) as a result of missing values.

Cluster analysis of the data matrix (**Fig. 2**) mirrors and confirms the results of the ordination (**Fig. 1**).

These five groups are recognised as five discrete species in the following taxonomic account.

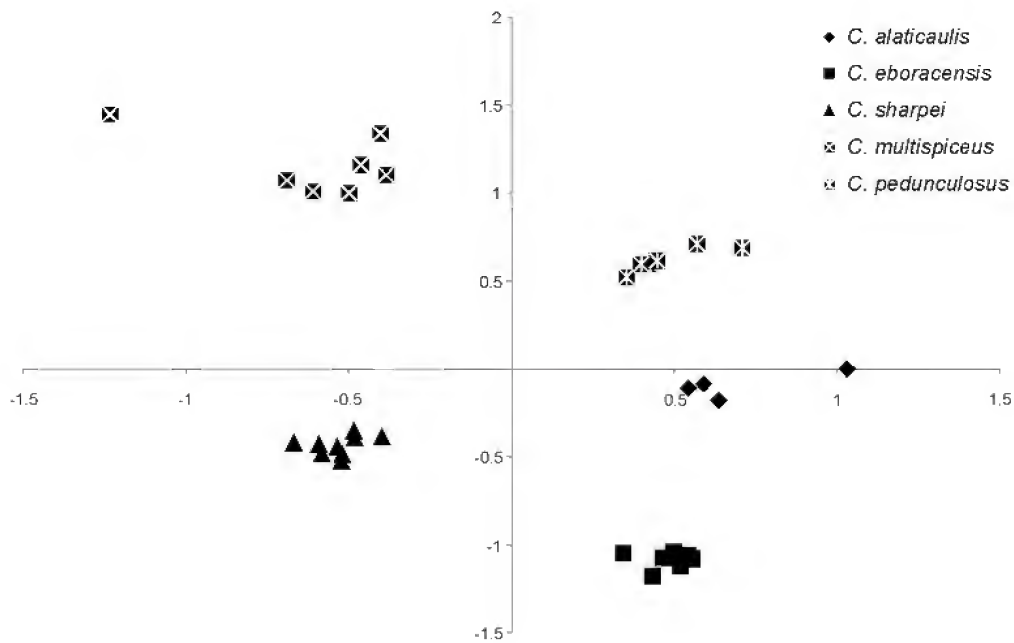


**Fig. 1. Ordination plot of the data matrix**  
Character states unweighted; Gower association measure; semi-strong-hybrid multidimensional scaling in 2-dimensions with 200 random starts. Stress value = 0.0837.

Taxonomy

Key to the *Cyperus pedunculosus* species group

- 1 Inflorescence simple. . . . . 2
- 1. Inflorescence compound . . . . . 3
- 2 Culms winged; proximal involucre bract 3–4.3 mm wide. . . . . 2. *C. alaticaulis*
- 2. Culms not winged; proximal involucre bract 1.5–2.8 mm wide. . . . . 3. *C. eboracensis*
- 3 Culms mostly trigonous; closely arranged on a stout rhizome, occurs in skeletal soils in eucalypt woodland. . . . . 5. *C. sharpei*
- 3. Culms mostly triquetrous; tufted, occurs in and adjacent to closed and riparian forests . . . . . 4
- 4 Inflorescence of 4–12 spikes . . . . . 1. *C. pedunculosus*
- 4. Inflorescence of 20–80 spikes . . . . . 4. *C. multispiceus*

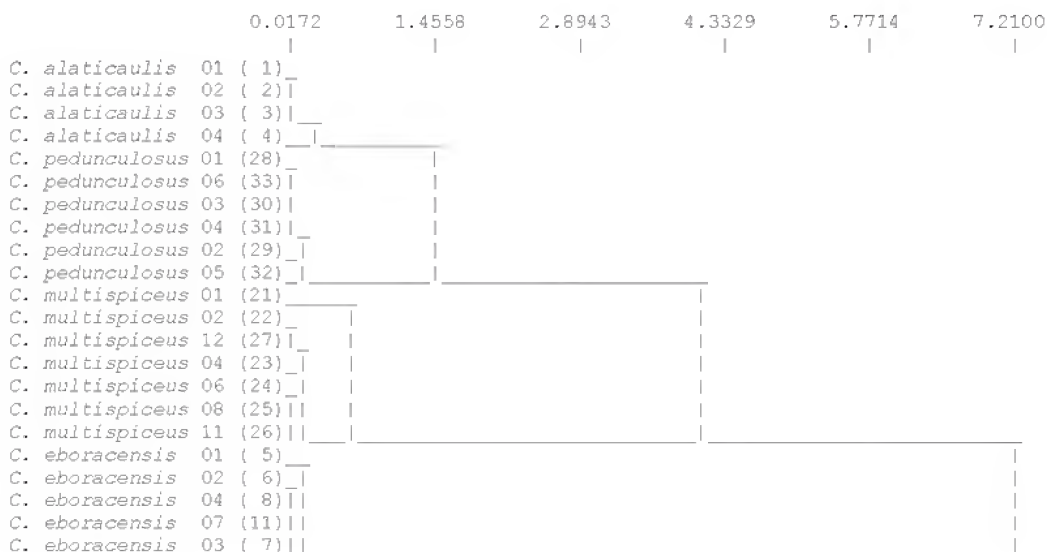


**Fig. 2. Phenogram of the data matrix**

Character states unweighted; Gower association measure; and UPGMA ( $\beta = -0.25$ ) fusion strategy (data matrix 1).

**1. *Cyperus pedunculosus*** F.Muell., *Fragm.* 8: 266 (1874); *C. pedunculosus* var. *pedunculosus* Domin, *Biblioth. Bot.* 85: 425 (1915). **Type citation:** “Ad oram Rockingham’s Bay in altis montibus rupestribus, atque secus fluvios silvarum; Dallachy”. **Type:** Queensland. Rockingham’s Bay, *s.dat.*, *J.Dallachy s.n.* (holo: MEL *n.v.*; iso: BRI [AQ308150]).

*Cyperus montis-sellae* K.Schum., *Bot. Jahrb. Syst.* 18: 186 (1894). **Type:** Papua New Guinea. “Auf dem Gipfel des Sattelberges”, 14 January 1889, *D.Hellwig* 249 (*n.v.*).

*Cyperus pedunculosus* var. *floribundus* Kük., *Bot. Jahrb.Syst.* 59: 44 (1924). **Type:** Papua New Guinea. Sattelberg, *C.Nyman* 491 (*n.v.*).

*Cyperus pedunculosus* var. *atrocastaneus* Kük., *Bot. Jahrb. Syst.* 69: 256 (1938). **Type:** Papua New Guinea. CENTRAL PROVINCE: Isuarava, *C.E.Carr* 15451 (syn: *n.v.*); Papua New Guinea. MOROBE PROVINCE: Ogeramnang, *M.S.Clemens* 4978 (syn: *n.v.*); Papua New Guinea. MOROBE PROVINCE: Mt Sarawaket, *M.S.Clemens* 6071 (syn: *n.v.*).

*Cyperus pedunculosus* var. *alatus* Kük., *Mitt. Thür. Bot. Ver. N.F.* 50: 3 (1943). **Type:** Papua New Guinea. MOROBE PROVINCE: Boana, 3 November 1938, *M.S.Clemens* 8772b (*n.v.*).

*Cyperus pedunculosus* var. *longebracteatus* Domin, *Biblioth. Bot.* 85: 425 (1915). **Type citation:** “Nordost-Queensland: Bellenden-Ker, in der Nähe eines Baches in einer Höhe von ungefähr 200 m, selten (DOMIN, XII. 1909).” **Type:** (holo: PR, *n.v.*).

*Plants* robust, perennial with a short rhizome. *Culms* tufted, erect, triquetrous to distinctly 3-winged, striate, 25–45 cm long, 2–5 mm wide, thickened by inflated, scarious, purplish sheaths. *Leaves* longer than inflorescence culm, canaliculate at the base, otherwise flat, 6–20 mm wide. *Involucral bracts* 5–6, 30–45 cm long, 6–15 mm wide, unequal in length, longer than inflorescence, scabrous. *Inflorescence* once compound, or decompound, 10–20 cm long, 7–12 cm wide, diffuse. Rays unequal, (3–)6–11(–15). *Spikes* 6–12; sessile or pedunculate, ovoid, spreading, dense, 5–25 mm long, 8–40 mm

**Table 2. Correlations of character states and ordination vectors.**

| Character state                                   | Correlation |
|---------------------------------------------------|-------------|
| Culm cross section trigonous                      | 0.9668      |
| Culm cross section triquetrous                    | 0.9668      |
| Base of primary inflorescence bract teeth absent  | 0.9528      |
| Base of primary inflorescence bract teeth present | 0.9528      |
| Involucral bracts septate nodules absent          | 0.9151      |
| Involucral bracts septate nodules present         | 0.9151      |
| Style length (mm)                                 | 0.8489      |
| Glume mucro length <0.3 mm                        | 0.8084      |
| Glume mucro length 0.3–0.7 mm                     | 0.8084      |
| Rachilla wing absent                              | 0.7224      |
| Rachilla wing present                             | 0.7224      |

wide, with 1–7 spikelets. *Spikelets* 5–25 mm long, 2.5–3.2 mm wide, 10–40(–50)-flowered, digitate, spreading, linear, reddish brown to dark brown to dark grey to black. *Glumes* distichous, 2.5–3.5 mm long, dark reddish or red-brown or blackish-red or ferrugineous or streaked red-brown, apex mucronulate or mucronate or acuminate, mucro excurved or straight, one third to two thirds imbricate, keeled, 1.1–1.3 mm apart, 4–10 nerved, with arcuate keel. Rachilla straight, persistent, winged. *Stamens* 3; anthers linear; connective setulose; 0.5–0.9 mm long. *Style* shorter than stigmas, 3-fid, 1.2–1.5 mm long. *Nut* obovoid to ellipsoid; trigonous to triquetrous, or dorsiventrally compressed or flattened with a flat or concave face against the rachilla, half as long as the glume, 1.5–2 mm long, 1–1.25 mm wide, smooth or densely granulose or granulate, with sides exposed, apex apiculate or rounded, brown to golden brown.

**Additional selected specimens examined:** **Papua New Guinea.** EASTERN HIGHLANDS PROVINCE: Kini Creek, NE slopes of Mt Michael, Sep 1959, *Womersley NGF11715* (BRI). MOROBE PROVINCE: 5 km from Markham River Bridge along road to Labu, Jul 1992, *Forster PIF11067 & Liddle* (BRI, LAE). NORTHERN PROVINCE: N slope of Mt Lamington, Jul 1953, *Hoogland 3320* (BRI). CENTRAL PROVINCE: E slope of Lake Myola No. 2, Sep 1973, *Croft NGF34536* (BRI). **Queensland.** COOK DISTRICT: Davies Creek, S.F.607, 9 km past N.P. carpark, Jun 1991, *Forster PIF8536* (BRI); Bellenden Ker, 40 m below tower 3, May

2001, *Booth et al. 2614* (BRI, K, NSW); Foothills of Mt Bellenden Ker, May 2001, *Cooper 1529* (BRI); Bellenden Ker Cable Car Station, Jan 2002, *Booth et al. 2834* (BRI); Junction Creek, Russell River, Apr 1948, *Brass 18262* (BRI); Wooroonooran N.P., CSIRO EP/34, off Russell River track, Jan 2007, *Ford AF4910 & Metcalfe* (BRI, NSW); Bartle Frere, Oct 1935, *Blake 9758* (BRI); East Bartle Frere, Nov 1994, *Hunter JH1837* (BRI). WIDE BAY DISTRICT: Fraser Island, Oct 1930, *Hubbard 4396* (BRI); Fraser Island, May 1964, *Webb 6328* (BRI, CANB); track up to Mt Bowarrady tower, Fraser Island, Sep 1986, *Russell-Smith 1809 & Lucas* (BRI). MORETON DISTRICT: McDonald Road, 3 km N of Peachester, Jul 1993, *Bean 6256* (BRI); Mooloolah Scrubs, Dec 1890, *Field Naturalists s.n.* (BRI [AQ 647235]); Base of Buderim Mt., Mar 1934, *Blake 5251* (BRI).

**Distribution and habitat:** *Cyperus pedunculatus* is found throughout coastal Queensland from Buderim north to Davies Creek near Cairns. It is also widely distributed in New Guinea. Plants occur in wet forests often along shady creek banks.

**Notes:** A number of varieties have been named under *Cyperus pedunculatus*, three from Papua New Guinea (Kükenthal 1924, 1939, 1943) and one from north Queensland (Domin 1928). Blake (1947) and Kern (1974) were of the opinion that these varieties and also *Cyperus montis-sellae* K.Schum. were merely minor variations of *C. pedunculatus* and this is also our conclusion based upon the protologue descriptions by Schumann

(1894) and Kükenthal (1924, 1938, 1943). Although we have not seen the type of Domin's variety, it is clearly illustrated in his account and from the brief description of the specimen in the protologue, it differs only in the longer involucre bracts from typical *C. pedunculatus*. Hence, neither the name *Cyperus montis-sellae* or any of the previously published varieties of *C. pedunculatus* are applicable to the species being described as new in this paper.

**2. *Cyperus alaticaulis*** R.Booth, D.J.Moore & Hodgson, **species nova** a *Cypero pedunculato* inflorescentia simplici (in illo complexo), spiculis pluribus in quaque spica (10–25 non 1–7) et stamine solitario (in illo 3) differens. **Typus:** Queensland. COOK DISTRICT: 26 km WSW of Lockhart River township, 7 km SSE of Mount Bowden, Cape York mapping site 679 (HEL 41), 20 April 1993, J.R.Clarkson 9933 & V.J.Neldner (holo: BRI; iso: CNS, K, NSW).

*Cyperus* sp. (Chester River J.R.Clarkson 2392); Booth (2007: 58).

*Plants* slender, perennial, glabrous. *Culms* tufted, erect, triquetrous, increasingly winged towards the distal end, 19–36 cm long, 1–3.8 mm wide; base swollen and bulbous. *Leaves* basal, 8–20 cm long, 2.5–4 mm wide, septate-nodulose. *Involucre bracts* 2–5, unequal in length, longer than inflorescence. Proximal bract 4–12 cm long, 3–4.3 mm wide. *Inflorescence* simple, 1–2 cm long, 1–2.5 cm wide. *Spike* globose or ovoid, dense, 10–20 mm long 10–25 mm wide, with 5–30 spikelets. Rachis angular. winged. *Spikelets* 10–20 mm long, 2.5–3.5 mm wide, 10–35-flowered, straight, digitate, spreading or reflexed, linear to linear-lanceolate. *Glumes* distichous, 2.2–2.8 mm long, apex mucronate, one half to two thirds imbricate, keeled, 1–1.2 mm apart, 1 or 2 nerved, with arcuate keel. Rachilla straight. *Stamens* 1. Anthers 0.5–0.8 mm long. *Style* 0.7–1.1 mm long, 3-fid, longer than or as long as stigmas, shorter than nut, flat. *Nut* ellipsoid, trigonous, one third to half as long as glume, 1.2–1.8 mm long, 0.7–1 mm wide, granulose, apex rounded, dark brown to brown. **Fig. 3 A–E.**

**Additional selected specimens examined: Queensland.** COOK DISTRICT: 1 km SE of Heathlands, near the pump site, Mar 1992, Clarkson 9309 & Neldner (BRI, DNA, K, MBA, NSW, P); Chester River, on Eastern fall of McIlwraith Range, Jul 1978, Clarkson 2392 (BRI); 9 km N of Batavia Downs on the Peninsula Development Road, Apr 1990, Clarkson 8531 & Neldner (BRI, K, NSW).

**Distribution and habitat:** *Cyperus alaticaulis* is endemic to Queensland on northern Cape York Peninsula where it has been recorded from the Chester River northwards (**Map 1**). Plants grow in dry sandy loams in eucalypt woodland.

**Notes:** *Cyperus alaticaulis* is distinguished within this group by the simple inflorescence, winged culms and broad, proximal involucre bracts (3–4.3 mm wide).

It is not a common species and has only been collected at four localities. Although it is found in a similar habitat to *Cyperus eboracensis* it can be easily distinguished from that species by the winged culms and broader involucre bracts.

**Etymology:** From the Latin *alatus* (winged) and *caulis* (stemmed), so named because the culm becomes increasingly triquetrous towards the distal end.

**3. *Cyperus eboracensis*** R.Booth, D.J.Moore & Hodgson, **species nova** a *Cypero pedunculato* inflorescentia simplici (in illo complexo) et cauli basi tumido bulbosoque differens. **Typus:** Queensland. COOK DISTRICT: 3.7 km E of the Peninsula Development Road on an IWS track leaving the main road 0.5 km N of the Laura River, 26 April 1983, J.R.Clarkson 4721 (holo: BRI; iso: NSW).

*Cyperus* sp. (Cape York J.R.Clarkson +8126); Booth (2007: 58).

*Plants* slender, perennial, glabrous. *Culms* tufted, erect, triquetrous, striate, glabrous, 30–60 cm long, 0.6–1 mm wide, base swollen and bulbous. *Leaves* basal, 12–30 cm long, 1–3.5 mm wide. *Involucre bracts* 4–6, unequal in length, longer than inflorescence, scabrous. Proximal bract 5–30 cm long, 1.5–2.8 mm wide. *Inflorescence* simple, 10–25 mm long, 10–30 mm wide. *Spike* sessile, globose, ovoid or hemispherical, dense, 10–25 mm

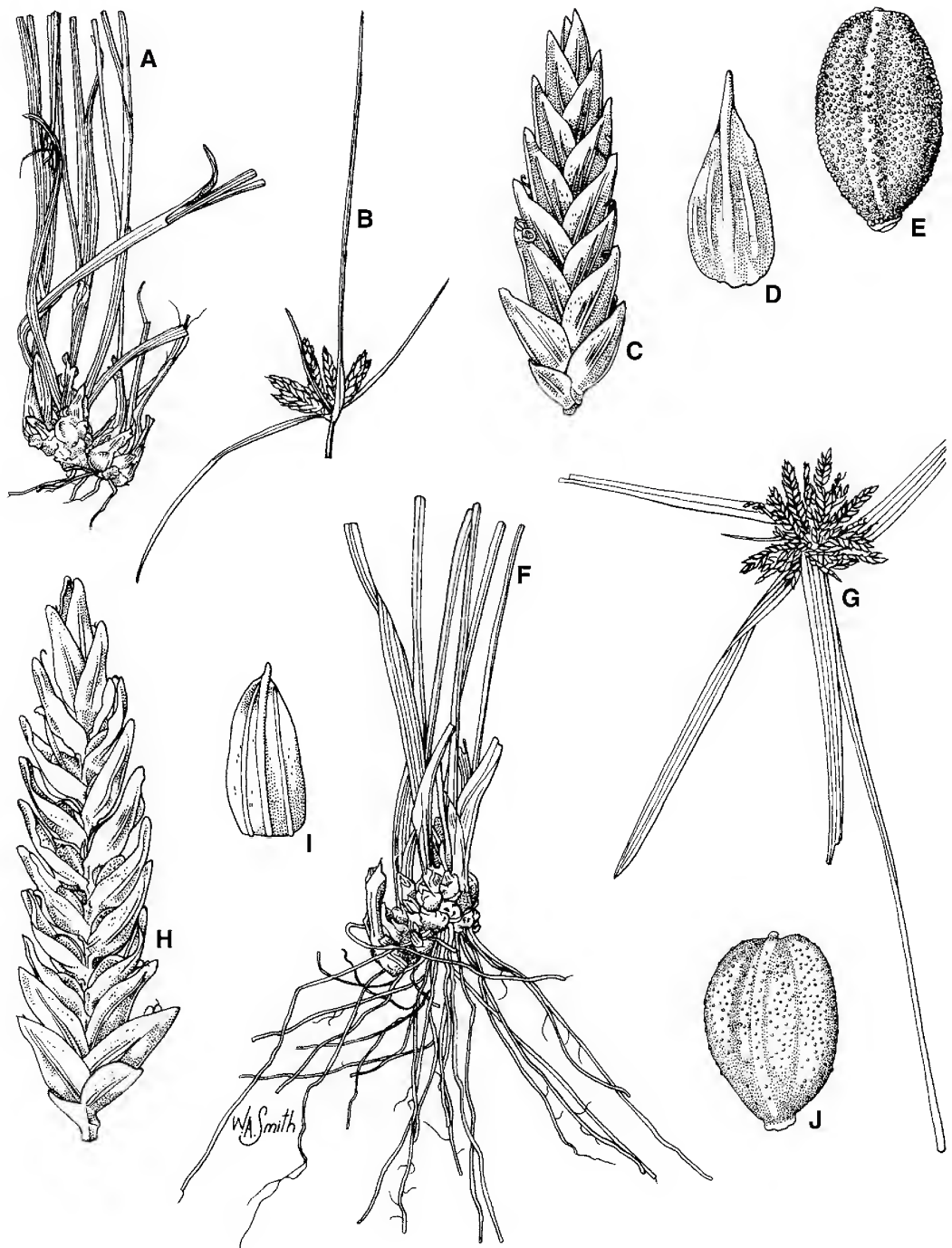


**Fig. 3.** *Cyperus alaticaulis*, A. base of plant showing bulbous base of culms  $\times 1$ . B. inflorescence  $\times 1$ . C. spikelet  $\times 6$ . D. glume  $\times 12$ . E. nut  $\times 24$ . *C. eboracensis*, F. base of plant showing bulbous bases  $\times 1$ . G. inflorescence  $\times 1$ . H. spikelet  $\times 6$ . I. glume  $\times 12$ . J. nut  $\times 24$ . A–E Clarkson 2392 (BRI); F–J Wannan 4515 (BRI).

long, 10–30 mm wide, with 10–30 spikelets. *Spikelets* 10–25 mm long, 1.8–2.5 mm wide, 10–40 flowered, sessile, straight, digitate, erect, linear or linear lanceolate. *Glumes* 2.4–3 mm long, apex mucronulate or acute, one half to two-thirds imbricate, keeled, 1.2–1.4 mm apart, 1–3-nerved (one prominent), with an arcuate keel. Rachilla straight, persistent, winged. *Stamens* 2 or 3; anthers linear, connective smooth, 0.5–1 mm long. *Style* longer than stigmas, 3-fid, shorter than nut, flat, 0.7–1 mm long. *Nut* obloid to obovoid to ellipsoid, trigonous, faces convex, one-third to half as long as the glume, 1.2–1.5 mm long, 0.7–0.9 mm wide, granulose, falling with glume, apex apiculate, dark brown to brown. **Fig. 3 F–J.**

**Additional specimens examined: Queensland.** COOK DISTRICT: St. Paul's Village, Moa Island, Torres Strait, May 1999, *Waterhouse BMW5324* (BRI, CANB); 36.2 km from Peninsula Development Road along road to Portland Roads, site CY254, Jul 1991, *Neldner 3517* & *Clarkson* (BRI, MBA); 11.5 km W of the Laura to Musgrave road on the track to Dixie, Cape York mapping site 21 (DIX 20), Jun 1989, *Clarkson 8126* & *Neldner* (BRI, DNA, K, NSW); 1.5 km NW of Marina Plains homestead, site CY415 (MP17), Apr 1992, *Neldner 3758* & *Clarkson* (BRI, DNA, NSW, PERTH, QRS); S of Five Mile Creek, May 2004, *Wannan 3550* & *Verdec* (BRI); 20.4 km from the McIvor River crossing on the Hopevale to Starcke road towards Battlecamp, May 1993, *Clarkson 10071B* & *Neldner* (BRI, K, NSW).

**Distribution and habitat:** *Cyperus eboracensis* is endemic to Queensland where it has been recorded from the Daintree River north to Moa Island (**Map 2**). Plants grow in dry sandy loams in eucalypt woodland.

**Notes:** *Cyperus eboracensis* is distinguished within this group of species by the simple inflorescence, the unwinged culms and relatively narrow, proximal involucre bracts (1.5–2.8 mm wide).

**Etymology:** From the Latin *eboracum*, the Romano-British name for York, England and *-ensis*, suffix indicating origin or place; the species is restricted to Cape York.

**4. *Cyperus multispiceus* R.Booth, D.J.Moore & Hodgon, species nova** a *Cypero pedunculoso* spicis pluribus in quaque inflorescentia (20–80 non 4–12) et antheris longioribus (1.2–1.7 non 0.5–0.9 mm) differens. **Typus:** Queensland. COOK DISTRICT: Cotterell River, 13 km S of Vrilya

Point. Cape York mapping site 673 (HEL 35), *J.R.Clarkson 9882* & *V.J.Neldner* (holo: BRI; iso: K, NSW).

*Cyperus* sp. (The Boulders J.A.Elsol 818); Booth (2007: 58).

*Plants* robust, perennial, glabrous. *Culms* tufted, erect, triquetrous, striate, 39–76 cm long, 1.4–3.3 mm wide; bases thickened by split, fibrous sheaths. *Leaves* basal, 80–120 cm long, 6–15 mm wide. *Involucral bracts* 4–8, unequal in length, longer than inflorescence, scabrous, septate-nodulose. Proximal bract 19–65 cm long, 3.8–9.8 mm wide. *Inflorescence* decompound, 10–20 cm long, 12–20 cm wide, diffuse. Rays unequal, 9–20. *Spikes* 20–80, globose or ovoid or hemispherical, dense, 10–20 mm long, 15–30 mm wide, with 6–10 spikelets. *Spikelets* 10–20 mm long, 1.8–3.5 mm wide, 10–40 flowered, straight, digitate, erect or spreading, linear. *Glumes* 2–3 (3.3) mm long, apex mucronulate, one half to two-thirds imbricate, keeled, with excurved or straight mucro, 0.9–1.1 mm apart, 3–5 nerved; with arcuate keel. Rachilla straight, winged. *Stamens* 3; anthers linear, connective setulose, 1.2–1.7 mm long. *Style* shorter than stigmas, 3-fid, shorter than nut, flat, 0.3–0.6 mm long. *Nut* obovoid, trigonous, faces concave to flat, half to two-thirds as long as glume, 1.1–1.7 mm long, 0.7–1 mm wide, granulose, apex apiculate, brown to golden brown. **Fig. 4 F–K.**

**Additional selected specimens examined: Queensland.** COOK DISTRICT: Pajinka, Cape York, Feb 2001, *Cooper 1484* & *Jensen\** (BRI); Newcastle Bay, 2.5 miles [4.1 km] S of Somerset, May 1948, *Brass 18689* (BRI); 1 km SE of Heathlands, Mar 1993, *Clarkson 9308* & *Neldner* (BRI, NSW); Mouth of Pennefather River, Jul 1988, *Dalliston CC306\** (BRI); Restoration Beach, c. 5 km SW of Cape Weymouth, Feb 1980, *Clarkson 2943\** (BRI, NSW); Upper slope of Altanmoui Range, Cape Melville N.P., May 1993, *Neldner 3971\** (BRI, NSW); N.P.R. 133, Mt Sorrow ridge walk, Nov 2000, *Ford AF2492\** (BRI); Mossman River Gorge, Feb 1932, *Brass 2120* (BRI); Mossman Gorge N.P., Dec 1997, *Forster PIF21950* (BRI); Hills Creek, Murray Prior Range, Mar 2001, *Booth 2538 et al.\** (BRI); Near Stoney Creek Falls, near Cairns, May 1962, *Blake 21742\** (BRI); Freshwater Creek, Jul 1974, *Byrnes 3069\** (BRI); Lake Morris road, Feb 1994, *Jago 3069* (BRI); Hann Tableland, Oct 2005, *Jago 6863\** (BRI); Gadgarra via Fuller Road, Mar 2002, *Booth 2975* (BRI); Douglas Track to Glacier Rock, Dec 2001, *Jensen 1154* (BRI).

**Distribution and habitat:** *Cyperus multispiceus* is endemic to Queensland and has been recorded from Palmerston N.P. northwards to Cape York (**Map 3**). It is found on the margins of rainforest and amongst riparian and semi-deciduous vine forest on coarse sandy loams. *Cyperus multispiceus* is often seen resprouting while evidence of recent fire is still clearly visible.

**Notes:** *Cyperus multispiceus* is distinctive within this group of species by the tufted habit, triquetrous culms and large number of spikes (20–80) in the compound inflorescence. The bases of the plants are much thickened by the fibrous sheaths.

The Queensland Herbarium has 42 collections of *Cyperus multispiceus*, but only a handful possesses spikelets with fully mature nuts (without \* in specimens cited above). The plants seem to reproduce predominately vegetatively. Many specimens have white immature nuts, the sides of the nuts being clearly visible within the spikelets. The mature nuts, when present are golden brown to brown. Often the glumes and nuts fall away, leaving behind the rachis which has the remains of the three stamens still attached to it (**Fig. 4I**). These features also occur in the other three new species that are described in this paper and may reflect a common origin for these species.

The specimen *Jago 4586* from Mt Sorrow W of Cape Tribulation possesses glumes that are mucronate and up to 3.5 mm long, but this is atypical.

**Etymology:** From the Latin *multi-* (many) and *spiceus* (spiked), so named because of the numerous spikes in the inflorescence.

**5. *Cyperus sharpei*** R.Booth, D.J.Moore & Hodgson, **species nova** a *Cypero pedunculosa* rhizomate obesiore et habitatione in clivis aridis saxosis non in silva humidissima differens. **Typus:** Queensland. COOK DISTRICT: Watsonville, 29 July 1967, *L.J.Brass 33616* (holo: BRI).

*Cyperus* sp. (Herberton P.R.Sharpe 1449); Booth (2007: 58).

*Plants* slender, perennial, glabrous, slightly glaucous. *Culms* erect, trigonous, striate, 30–

45 cm long, 0.6–2 mm wide, with a bulbous base on a short, stout rhizome. *Leaves* basal, 30–65 cm long, 1–5 mm wide. *Involucral bracts* 3–5, unequal in length, longer than inflorescence, scabrous. Proximal bract 10–23 cm long, 1.4–3.8 mm wide. *Inflorescence* once compound, 3–6 cm long, 3–9 cm wide, dense. Rays unequal, 1–6. *Spikes* 2–7, globose or ovoid or hemispherical, dense, 7–25 mm long, 12–30 mm wide, with 6–20 spikelets. *Spikelets* 7–25 mm long, 2.1–3.3 mm wide, 10–34 flowered, digitate, spreading, linear. *Glumes* distichous, 2.5–3.4 mm long, apex mucronate, one half to two thirds imbricate, keeled, with straight mucro, 1.4–1.6 mm apart, 4–6 nerved, with a straight keel. Rachilla straight, winged. *Stamens* 3; anthers linear, connective setulose, 1.2–1.5 mm long. *Style* shorter than stigmas, flat, 0.4–1 mm long. Stigmas 3. *Nut* obovoid to ellipsoid, trigonous, half as long as glume, 1.5–1.9 mm long, 0.7–1 mm wide, granulate, apex apiculate to rounded; brown to light brown. **Fig. 4 A–E.**

**Additional selected specimens examined: Queensland.** COOK DISTRICT: On Silver Valley Road, 3.4 km from Mt Misery, Atherton, Apr 1988, *Forster PIF3967* (BRI). NORTH KENNEDY DISTRICT: Herberton Range, Toy Creek, Feb 2001, *Booth 2568* (BRI); Top of ridge behind Caravan Park, Herberton, Jun 1975, *Sharpe s.n.* (BRI [AQ468247]); Herberton, Jan 1918, *Michael s.n.* (BRI [AQ 320372]); Mountain behind Caravan Park, 2 km N of Herberton on road to Atherton, Jun 1975, *Sharpe 1455* (BRI); Junction of Cooloomoon and little Cooloomoon Creeks, SW of Herberton, May 1962, *Whitehouse s.n.* (BRI [AQ 320373]); 1.5 km W of Herberton on Herberton – Petford road, May 1983, *Conn 1143* (BRI); Hillside behind Caravan Park, Herberton, on Atherton road, June 1975, *Sharpe 1449* (BRI).

**Distribution and habitat:** *Cyperus sharpei* is endemic to Queensland where it has been recorded predominantly from the Herberton Range and vicinity; there also appears to be a population at Mt Mulligan, an outlying sandstone formation near Dimbulah (**Map 4**). Plants grow in open eucalypt woodland in skeletal soils.

**Notes:** *Cyperus sharpei* is distinctive within this group of species by the compound inflorescence, the trigonous culms and the stems closely arranged on a stout rhizome.

The Queensland Herbarium holds six collections of *Cyperus* from this group collected in the Mt Mulligan area, two

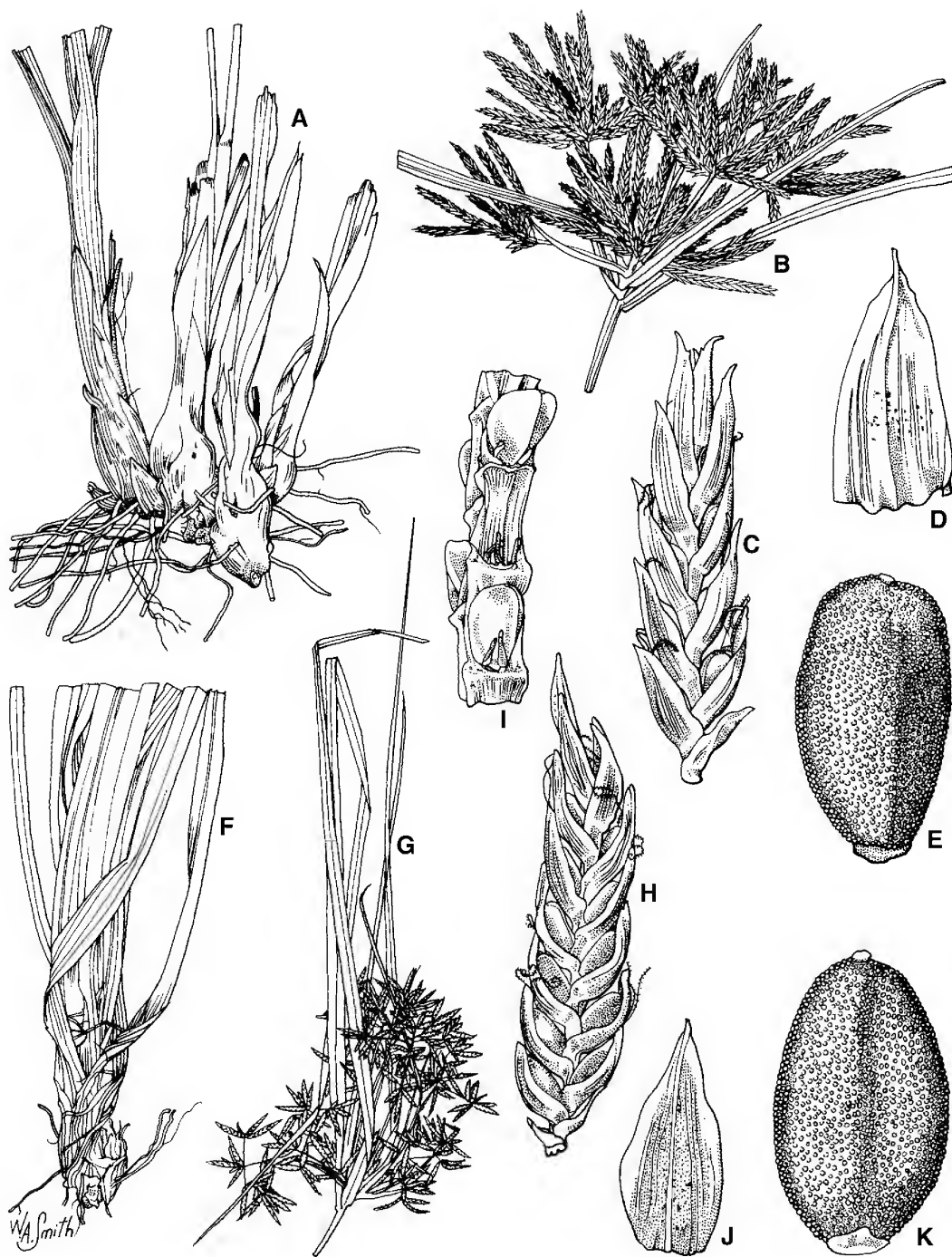


**Fig. 4.** *Cyperus sharpei*, A. base of plant showing culms on a short rhizome  $\times 0.8$  B. inflorescence  $\times 1$ . C. spikelet  $\times 6$ . D. glume  $\times 12$ . E. nut  $\times 24$ . *C. multispiceus*, F. base of plant showing fibrous sheaths  $\times 0.4$ . G. inflorescence  $\times 0.3$ . H. spikelet  $\times 6$ . I. rachilla after glumes and nuts have fallen away showing remains of stamens  $\times 12$ . J. glume  $\times 12$ . K. nut  $\times 24$ . A–E Sharpe 1449 (BRI); F–K. Jensen 1154 (BRI).

(Clarkson 6913b, Duretto 378) have been tentatively identified as *Cyperus multispiceus* and four (Clarkson 5830a, 5892, Fox AQ764123, Jago 3487) as *C. sharpei*. None of these collections are fully mature and they seem to represent depauperate forms of the respective species. This immaturity makes precise identification of the plants difficult and further collections from this particular area are required for taxonomic clarification.

**Etymology:** Named in honour of Philip Ridley Sharpe, former curator of Cyperaceae at the Queensland Herbarium and author of a ground breaking synoptic account of the family in Queensland (Sharpe 1986).

### Acknowledgements

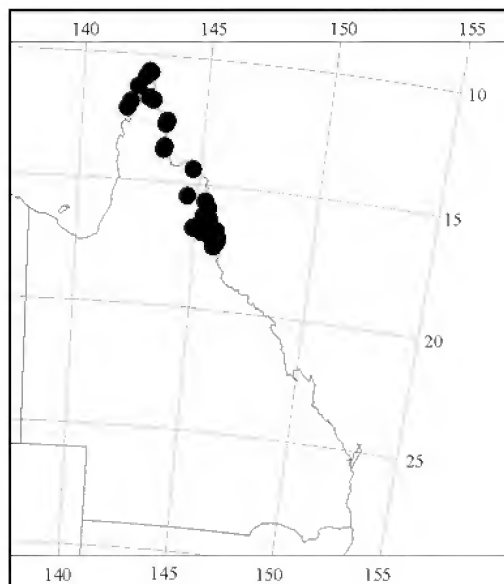
Thanks to Will Smith for the illustrations, Peter Bostock for the Latin diagnoses and Laurie Jessup for proof reading and guidance.

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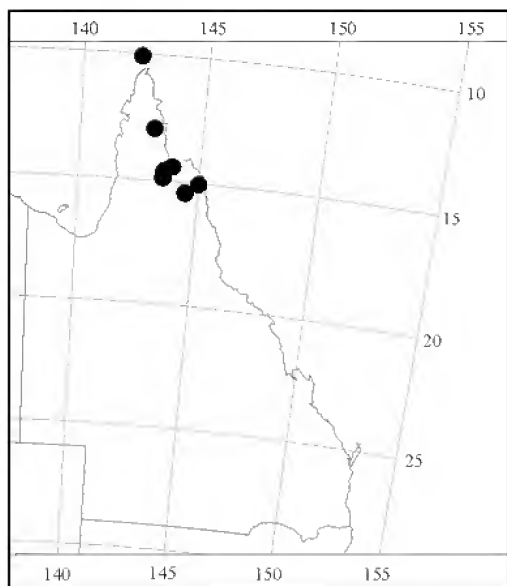
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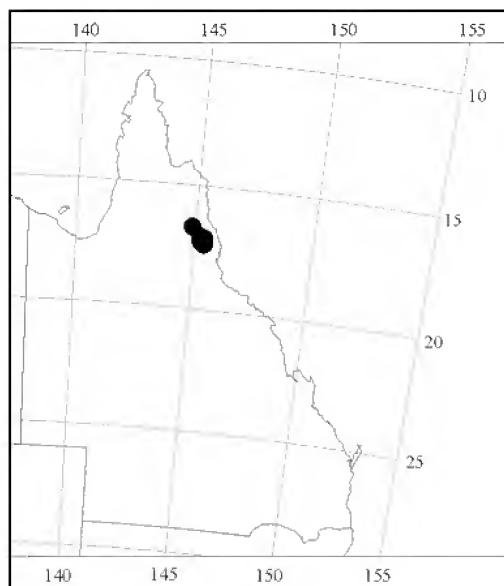
**Map 1.** Distribution of *Cyperus alaticaulis*



**Map 3.** Distribution of *Cyperus multispiceus*



**Map 2.** Distribution of *Cyperus eboracensis*



**Map 4.** Distribution of *Cyperus sharpei*

# *Duperreya* Gaudich. (Convolvulaceae) revisited

R.W.Johnson

## Summary

Johnson, R.W. (2009). *Duperreya* Gaudich. (Convolvulaceae) revisited. *Austrobaileya* 8(1): 47–54. The history of the genus *Duperreya* Gaudich. and its reinstatement in Australia is discussed. Three species are recognised and a key is provided for their identification. *Duperreya halfordii* R.W.Johnson is described as new. Descriptions and distribution maps are provided for all species as well as information on their distribution, habitat and phenology. Key identification characters are illustrated.

Key Words: Convolvulaceae, Australian flora, *Duperreya*, *Duperreya halfordii*, *Porana*

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## Introduction

The genus *Duperreya* was described by Gaudichaud (1829) based on a specimen he collected from Shark Bay in Western Australia. Both Choisy (1837, 1845) and Endlicher (1839) maintained *Duperreya* as a monotypic genus closely related to *Porana* Burm.f. Mueller (1867) concluded that *Duperreya* was a synonym of *Porana* and transferred *D. sericea* Gaudich. to the larger and more widespread genus. However, Mueller (1860) had previously described *Ipomoea modesta* F.Muell. based on an Oldfield specimen collected beside the Murchison River in Western Australia. This name was illegitimate due to an earlier *I. modesta* described by Choisy (1854). Mueller also realised this taxon was the same as *Porana sericea* and noted this in his list of synonymy. Bentham (1869), Peter (1891) and Hallier (1893) accepted the transfer of *Duperreya* to *Porana* though Peter recognised its difference by including the genus in the monospecific section *Duperreya*. Schneider (1916) in a study of the genus *Porana* concluded *Duperreya* was sufficiently distinct from *Porana* to be maintained as a separate genus. Until recently Australian authors have followed Mueller's treatment of *Duperreya*.

Staples (1987) revised the Australian species of *Porana* and described a new species *P. commixta* Staples. More recently, Staples

(2006) published a comprehensive revision of the Asiatic *Poraneae* in which he reinstated the genus *Duperreya* comprising two species, *D. sericea* and *D. commixta* (Staples) Staples.

In preparing treatments of the Australian Convolvulaceae for the *Flora of Australia*, David Halford and I found that specimens of *Duperreya commixta* from Queensland and New South Wales did not fit within the species concepts proposed by Staples (1987, 2006). Staples (2006) did note that specimens of *D. commixta* from the Cobar area in New South Wales had wider sepals than those from Queensland and Western Australia but in other respects they were typical of that species. Further studies and the critical examination of specimens have now indicated that the eastern Australian populations are distinct from those of *D. commixta* in inland Western Australia.

## Materials and methods

This revision is based on specimen holdings in BRI, CANB, MEL, NSW and PERTH.

## Taxonomy

***Duperreya* Gaudich.**, in Freycinet, *Voyage Autour du Monde... sur les Corvettes de S. M. l'Uranie et la Physicienne*. Botanique t. 63 (1828); 452 (1829). **Type:** *D. sericea* Gaudich.

Perennials with climbing stems, woody at the base; indumentum sericeous, comprising appressed bifid hairs. Leaves shortly petiolate; blade linear to linear ovate, entire, with a

single pair of secondary veins arising from above the base of the blade. Inflorescence axillary, cymose; peduncle slender, with 2 persistent and opposite bracteoles, bearing a single flower; pedicel absent. Sepals 5, free, quincuncial, enlarging and becoming scarious at fruiting with 3–5 prominent longitudinal veins. Corolla campanulate to slightly funnel-shaped, shallowly 5-lobed, with sparsely hairy midpetaline bands. Stamens 5; filaments flattened and dilated downwards, fused to the corolla tube at the base, glabrous or tuberculate; anthers ovate-oblong, sagittate, apex rounded and emarginate, dehiscing longitudinally with no twisting. Ovary 1-celled, glabrous; ovules 2, basal; disc annular; style 1, filiform and bearing a bi-globose stigma. Utricle chartaceous, with a persistent style base, indehiscent; seed 1, glabrous, with a basal circular hilum.

**Etymology:** Named in honour of Louis-Isidore Duperrey, a marine officer, hydrologist and plant collector who accompanied Gaudichaud on the “Uranie” during the Freycinet expedition of 1817–1820.

**Distribution:** The genus is endemic to Australia and the three species occur in subtropical to warm temperate, arid to semi-arid areas.

### **Relationships and Diagnostic Characters:**

Hallier (1893) described the tribe *Poraneae* which included *Porana* and a number of other non-Australian genera. However, studies by Staples (1990) and Stefanovic *et al.* (2002) indicated that *Poraneae* was not monophyletic and embraced a number of unrelated genera. This has led to a reallocation of the genera assigned to the *Poraneae* (Stefanovic *et al.* 2003). *Porana* was transferred to the tribe *Dichondreae* (Choisy) Choisy, while some other genera including *Duperreya* were incorporated in a new tribe *Cardiochlamyae* Stefanovic & Austin. The closest relatives of *Duperreya* are the genera *Cordisepalum* Verdc., *Dinetus* Sweet, *Poranopsis* Roberty and *Tridynamia* Gagnep., all of which occur in southeast Asia. *Duperreya* is distinguished from these genera in having narrower leaves and solitary flowers. Staples (2006) also found the pattern of leaf venation in *Duperreya* (a single pair of secondary veins departing from the midvein near the base of the blade) distinguished it from its near relatives (with two pairs of secondary veins arising from the base).

### **Key to the species of *Duperreya***

- 1 Outer sepals narrowly ovate to narrowly elliptic, with L:B ratio >3, 3.5–6 mm wide at fruiting . . . . . **1. *D. commixta***
1. Outer sepals ovate to elliptic with a L:B ratio <2.5, >8 mm wide at fruiting . . . . . **2**
- 2 Outer sepals 3–5.5 mm wide at flowering with a L:B ratio <2 and 10–19 mm wide at fruiting with a L:B ratio of <1.5 . . . . . **2. *D. sericea***
2. Outer sepals 2.5–3 mm wide at flowering with a L:B ratio >2 and 8–11 mm wide at fruiting with a L:B ratio of >1.5 . . . . . **3. *D. halfordii***

**1. *Duperreya commixta*** (Staples) Staples, *Blumea* 51: 451 (2006); *Porana commixta* Staples, *Nuytsia* 6: 52 (1987). **Type:** Western Australia. 52 km W of Wiluna, 29 August 1970, P.G. Wilson 8965 (holo: PERTH *n.v.*; iso: A *n.v.*, CANB *n.v.*, K *n.v.*).

**Illustration:** Staples (1987: 53 fig 1; 55 fig 2), as *Porana commixta*.

Perennial; stems climbing, woody at the base, moderately to densely sericeous, becoming ± glabrous with age; bifid hair arms 0.1–0.3 mm long. Leaf petiole 0.3–1 (–2) mm long, 0.02–0.06 times as long as the blade; blade linear to linear-ovate, 15–50 mm long, 1–5 mm wide with a length:breadth ratio of 7.5–20, apex acute, base rounded to obtuse, sparsely to moderately densely sericeous above,

moderately densely sericeous below. Peduncle 6–16 mm long; bracteoles linear to narrowly elliptic, 2.5–5 mm long, 0.75–1.2 mm wide, extending to  $6 \times 1.5$  mm at fruiting, vestiture as for the leaves. Outer sepals narrowly oblong-elliptic to narrowly ovate, 5–8 mm long, 1.5–2.5 mm wide, with a length:breadth ratio of 3–3.5, apex acute to obtuse, base obtuse to rounded, becoming chartaceous and extending to  $19 \text{ mm} \times 6 \text{ mm}$  at fruiting with the length:breadth ratio increasing to 4, becoming rounded at the apex, moderately to densely sericeous, becoming sparse with age, with 5 prominent longitudinal veins; inner sepals linear to narrowly elliptic, 5–6.5 mm long, 1–2.5 mm wide, with a length:breadth ratio of 3.5–5.5, apex barely acute to obtuse extending to  $17 \text{ mm} \times 6 \text{ mm}$  at fruiting. Corolla blue to pale blue, slightly lobed; petals 8–12 mm long, 6–8 mm wide at the rim, rounded-triangular, apiculate at the distal end, sparsely to very sparsely hairy on the midpetaline band for 4–5 mm. Stamen filaments 2.5–4 mm long, fused to the base of the corolla tube for 0.5–0.9 mm; anthers 1.5–1.85 mm long, 0.8–0.9 mm wide, basal lobes 0.3–0.4 mm long. Ovary 0.9–1.3 mm high; style 3.5–5 mm long. Utricle ellipsoid to slightly obovoid, 5.5–6.5 mm long, glabrous or with a few apical hairs, longitudinally striated; seed 4–5 mm long. **Fig. 1A & 1B.**

**Additional selected specimens (49 examined):** **Western Australia.** 9 miles [14.7 km] E of Wittenoom, Aug 1965, *Beaglehole 11546* (BRI, MEL, PERTH); 6 km S of Agnew, Leonora road, Sep 1978, *Beaglehole & Errey ACB59624* (PERTH); Coombawan Windmill, Wonganoo Station, Aug 1999, *Boladeras 86* (PERTH); on Murlunmylurna walk at crossing pool, Millstream, Jul 2004, *Byrne 1097* (PERTH); E side of Lyndon – Williambury road, Williambury, Aug 1981, *Cranfield 1842* (PERTH); 1.4 km N of Tindler Bore, Melangata Station, Sep 1987, *Cranfield 6166* (PERTH); Mt Magnet, Sep 1903, *Fitzgerald s.n.* (NSW645799, PERTH); Laverton, Sep 1909, *Maiden s.n.* (NSW181028); near Wittenoom Gorge, c. 100 miles [161 km] S of Marble Bar, 1952, *McMahon s.n.* (NSW645801); c. 30 km SW of Balfour Downs Homestead on track to Ethel Creek Homestead, Sep 1995, *Mitchell PRP541* (BRI, PERTH); Dairy Creek Station, c. 4 km N of homestead, Aug 2003, *Patrick et al. SP4813* (PERTH); “Palm Springs”, S tributary of Fortescue River, Oct 1974, *Rodd 2826* (NSW); near Meekatharra, Oct 1958, *Speck 1501* (CANB, NSW, PERTH); 20 km NNW of New Springs Homestead, Sep 1979, *Toelken 6296* (AD, BRI); on NW Coastal Highway, 32 miles [51.5 km] S of Minilya Roadhouse, Sep 1976, *Whaite & Whaite 4201B* (NSW);

9.7 km S of Bullstag Well, “Balfour Downs”, Sep 1991, *Wilson 967 & Rowe* (NSW). **Northern Territory.** 2.5 km N. Puntitjata Outstation, Oct 2001, *Albrecht 10089* (DNA, PERTH).

**Distribution and habitat:** *Duperreya commixta* occurs in inland Western Australia from the Hamersley Ranges in the north to Laverton in the south (**Map 1**). It has also been recorded from the south western corner of the Northern Territory. It grows on rocky escarpments and along creeklines, on sandy, loamy or sandy-clay soils in *Acacia* thickets (especially mulga and lancewood) and in bloodwood woodlands.

**Phenology:** Flowering occurs in the late winter to spring from July to November with fruiting specimens collected through to March.

**Notes:** The specimen of *Duperreya commixta* collected by David Albrecht from 2.5 km N of Puntitjata Outstation in the far southwest of the Northern Territory currently appears to be from a remote outlier more than 500 km to the east of the main population.

**Conservation status:** This species does not appear to be under threat and is given no conservation status in Western Australia. However, the population discovered in the far southwest of the Northern Territory is significant from a conservation point of view given its disjunction.

**Etymology:** The specific epithet is derived from the Latin *commixtio*, mixture, referring to the fact that specimens of this species were mistaken for *D. sericea*.

**2. *Duperreya sericea*** Gaudich. in Freycinet, *Voyage Autour du Monde... sur les Corvettes de S. M. l'Uranie et la Physicienne. Botanique* t. 63 (1828); 452 (1829); *Porana sericea* (Gaudich.) F.Muell., *Fragm.* 6: 100 (1867). **Type:** Western Australia. Novae Hollandiae ora occidentalis (baie des Chiens-Marins) [Shark Bay], *C.Gaudichaud s.n.* (holo: P n.v.; iso: G n.v.); *fide* Staples (1986: 56).

*Ipomoea modesta* F.Muell., *Fragm.* 2: 22 (1860), *nom. illeg. non* Choisy (1854). **Type:** Western Australia. “in virgultis ad flumen Murchison”, *A.F.Oldfield s.n.* (holo: MEL n.v.; iso: K n.v.).

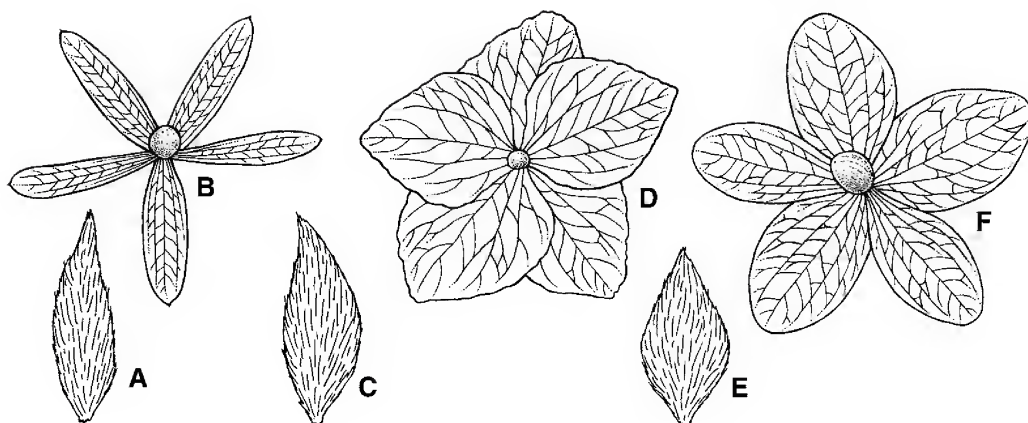


**Fig. 1.** *Duperreya commixta*. A. outer sepal at flowering  $\times 5$ , Mitchell 541 (BRI). B. calyx at fruiting  $\times 2$ , Wilson & Rowe 967 (NSW). *D. sericea*. C. outer sepal at flowering  $\times 5$ , Corrick 8153 (BRI). D. calyx at fruiting  $\times 2$ , Wilson & Rowe 1178 (NSW). *D. halfordii*. E. outer sepal at flowering  $\times 5$ , Benson & Cooper s.n. (BRI [AQ477737]). F. calyx at fruiting  $\times 2$ , Cunningham 520 (NSW). Del. B. Connell.

**Illustrations:** Staples (1987: 58, fig. 4), as *Porana sericea*; Staples (2006: 454, fig. 11).

Perennial; stems climbing, woody at the base, moderately dense to densely sericeous, becoming  $\pm$  glabrous with age; bifid hair arms 0.1–0.3 (–0.7) mm long. Leaf petiole 0.5–2 mm long, 0.02–0.06 times as long as the blade; blade linear to linear-ovate, 15–65 mm long, 2–6 mm wide, with a length: breadth ratio of 6.5–14.5, apex acute to barely obtuse, often slightly acuminate, base rounded to obtuse, moderately dense to densely sericeous on both sides. Peduncle 6–14 mm long; bracteoles elliptic, occasionally ovate or obovate, 2.7–4.5 mm long, 1–1.5 mm wide, extending to  $5 \times 2$  mm at fruiting, vestiture as for the leaves. Outer sepals broadly ovate to broadly elliptic, 5–8 mm long, 3–6 mm wide, with a length: breadth ratio of 1.4–1.6, becoming chartaceous, broader to almost orbicular and extending to 18 mm  $\times$  17 mm at fruiting with the length: breadth ratio decreasing to 1.1, apex acute to obtuse, becoming rounded, mucronulate, base obtuse to rounded, moderately densely sericeous becoming sparse with age, with 5 prominent longitudinal veins; inner sepals ovate-elliptic to elliptic, 5–7.5 mm long, 2.8–4 mm wide, with a length: breadth ratio of 1.2–1.9, extending to 16 mm  $\times$  15 mm at fruiting, apex barely acute to obtuse. Corolla blue to pale blue, slightly lobed, petals

8–12 mm long, 7.5–10 mm wide at the rim, rounded-emarginate, apiculate at the distal end, sparsely hairy on the midpetaline band for 4–5 mm. Stamen filaments 3–4.5 mm long, fused to the base of the corolla tube for 0.75–1 mm, glabrous or with an occasional low tubercle at the base; anthers 1.5–1.75 mm long, 0.75–0.85 mm wide, basal lobes 0.3–0.5 mm long. Ovary 0.8–1.2 mm high; style 4–5 mm long. Utricle obovoid to ellipsoid, 3.5–5 mm long, glabrous, surface wrinkled and longitudinally striated; seed 3–4 mm long. **Fig. 1C, 1D.**

**Additional selected specimens (34 examined): Western Australia.** NW of Geraldton, Aug 1967, *Ashby* 2266 (AD, BRI, PERTH); Woodleigh Station, E of Perth – Carnarvon road, Murchison, Aug 1960, *Burbidge* 6456 (BRI, CANB); 12 km N of Murchison River, Oct 1960, *Byrnes* 4028 (BRI, PERTH); Mount Elvire Station, Sep 1990, *Chapman & Kealley* 90-26 (PERTH); near Murchison River, c. 5 km upstream of Kalbarri, Sep 1982, *Corrick* 8153 (BRI, MEL); Pullagaroo Hill, Nov 1992, *Cranfield* 8646A (PERTH); 3 miles [c. 5 km] SE of Gravaloo Homestead, Sep 1970, *George* 10185 (PERTH); between Kununoppin & Mt Marshall & Lake Barlee, 1919, per *Grasby* s.n. (NSW181029); Isseka Road East, Northampton, Aug 1999, *Shepherd* 131 (PERTH); c. 12 km from Denham along main road to Monkey Mia, Aug 1986, *Short* 2458 (MEL, PERTH); on NW Coastal Highway, 32 miles [51.5 km] S of Minilya Roadhouse, Sep 1976, *Whaite & Whaite* 4201A (NSW); 29.8 km N of Meka Homestead, Sep 1991, *Wilson* 1172 & *Rowe* (NSW, PERTH); 7.5 km N of Murchison Shire Office, Sep 1991, *Wilson* 1178 & *Rowe* (NSW, PERTH); 10 km N of Murchison River on NW Coastal Highway, Sep 1979, *Wilson* 2657 (NSW).

**Distribution and habitat:** *Duperreya sericea* is found in coastal Western Australia from between Exmouth and Geraldton in the north to Northampton in the south, extending in the southern part of its range as far east as Menzies (**Map 1**). It grows in *Acacia* shrublands and heath along creeklines and on rocky escarpments, mainly on red sandy soils. In inland areas it is commonly found on granite.

**Notes:** Two specimens from the Swan River and Blackwood River housed in European herbaria were cited by Staples (1987). These collections were made in the 1800's. I am unaware of any collections in Australian herbaria from this area and in recent floras of this region the species is not listed. If the identification and locality information is correct then it appears this species no longer occurs in this area.

**Phenology:** Flowering occurs in the late winter to spring, from July to October with fruiting recorded through to April.

**Conservation status:** This species does not appear to be under threat and is given no conservation status in Western Australia.

**Etymology:** The specific epithetic refers to the sericeous indumentum which characterises this species.

**3. *Duperreya halfordii* R.W.Johnson species nova** differt a *D. commixta* sepalis praesertim fructiferis latioribus et sepalis florentibus, corolla, staminibus et stylis brevioribus. **Typus:** New South Wales. Lower part of gorge on W side of Mt Gunderbooka, 7 November 1987, *P.G.Wilson 166 & D.I.Wilson* (holotypus: BRI; isotypi: MEL *n.v.*, NSW *n.v.*).

**Illustrations:** Cunningham *et al.* (1981: 557), as Climbing Bindweed (*Porana sericea*); Johnson (1992: 378), as *Porana commixta*.

Perennial; stems climbing, woody at the base, moderately dense to densely sericeous, becoming  $\pm$  glabrous with age; bifid hair arms 0.1–0.25 mm long. Leaf petiole 0.5–2 mm long, 0.03–0.07 times as long as the blade; blade linear to linear-ovate, 10–35 mm long, 1–4 mm wide with a length:breadth ratio of 8.5–11.5, apex acute to barely obtuse, base rounded to obtuse, moderately to densely

sericeous on both sides. Peduncle 9–10 mm long at flowering, up to 16 mm long at fruiting; bracteoles narrowly ovate to elliptic, 3–4 mm long, 0.9–1.5 mm wide, extending to  $7 \times 3.5$  mm at fruiting, vestiture as for the leaves. Outer sepals ovate to ovate-elliptic, 4.5–6 mm long, 2–3 mm wide, with a length:breadth ratio of 2–2.4, apex acute to obtuse, base attenuate to obtuse, becoming broadly ovate, chartaceous and extending to  $20 \text{ mm} \times 11 \text{ mm}$  at fruiting with the length:breadth ratio decreasing to 1.5, rounded to almost emarginate at the apex, moderately to densely sericeous, becoming sparse with age with 5 prominent longitudinal veins; inner sepals elliptic to oblong-elliptic, 4.5–6 mm long, 1.8–2 mm wide, with a length:breadth ratio of 3.5–5.5, apex barely acute to obtuse, extending to  $18 \text{ mm} \times 10 \text{ mm}$  at fruiting and becoming obtuse to rounded at the apex. Corolla blue, slightly lobed, petals 7–10 mm long, 5–6 mm wide at the rim, rounded, sometimes emarginate at the distal end, sparsely hairy on the midpetaline bands for 3.5–4.5 mm. Stamen filaments 3.2–3.8 mm long, fused to the base of the corolla tube for 0.5–0.75 mm, glabrous or with an occasional low tubercle at the base; anthers 1.25–1.45 mm long, 0.6–0.7 mm wide, basal lobes 0.3–0.4 mm long. Ovary 1–1.4 mm high; style 3.5–4 mm long. Utricle ellipsoid, 4.5–5.5 mm long, glabrous or with a few hairs, surface wrinkled and longitudinally striated; seed 4–4.5 mm long. **Fig. 1E & 1F, Fig 2.**

**Additional specimens examined:** Queensland. WARREGO DISTRICT: Cunnamulla area, Feb 1972, *Pike 24* (BRI); mesa on Norley Homestead, c. 30.4 km N of Thargomindah, Jun 1955, *Smith 6344* (BRI). New South Wales. Cobar District, Oct 1970, *Althofer 147* (NSW); 13.3 km W of Cobar on Barrier Highway on S side of road, Nov 1984, *Benson & Cooper s.n.* (NSW645796); "Mulgowan", Nov 1984, *Benson & Cooper s.n.* (NSW251205); Mt Oxley, c. 20 miles [32.2 km] ESE of Bourke, Oct 1963, *Constable 4510* (NSW); 15 km W of Cobar P.O. along Barrier Highway towards Wilcannia, Dec 1986, *Crisp 7878* (CANB [CBG], NSW); Mark's paddock, "Burrawa", Dec 1969, *Cunningham 86* (NSW); 8 miles [12.9 km] W of Cobar, Nov 1972, *Cunningham 70* (NSW); 8 miles [12.9 km] W of Cobar, Nov 1972, *Cunningham 520* (NSW); 14.5 km W of Cobar on Barrier Highway, Oct 1974, *Cunningham & Milthorpe 2972* (NSW); 8 miles [12.9 km] W of Cobar, Oct 1911, *Haviland s.n.* (NSW251201); Tundulya, c. 25 miles [40.2 km] SE of Louth, Apr 1967, *Moore 4869* (CANB, NSW); Cobar, Dec 1905, *Watkin s.n.* (NSW181027); "Mt Gap", hill to SE of homestead, Nov 1987, *Wilson 169 & Wilson* (BRI, NSW).



**Fig. 2.** *Duperreya halfordii*. A. flowering branchlet  $\times 1$ . B. flower  $\times 4$ . C. corolla opened, with androecium  $\times 4$ . D. ovary and style  $\times 8$ . All from Cunningham & Milthorpe 2972 (NSW). Del. W.Smith.

**Distribution and habitat:** *Duperreya halfordii* occurs in south-western Queensland and western New South Wales from Cunnamulla in the north to Cobar in the south (**Map 1**). It grows on rocky hills and along stoney creeklines in *Acacia* thickets particularly mulga (*Acacia aneura*) and lancewood (*A. shirleyi*), and in red box (*Eucalyptus intertexta*) and leopardwood (*Flindersia maculosa*) communities on sandy or loamy, often shallow, red soils.

**Phenology:** Flowering has been recorded from September to November with fruiting through to February.

**Notes:** Staples (2006) noted that plants of *Duperreya commixta* from around Cobar had wider sepals than those from Queensland and Western Australia but the sepals appeared

intermediate in size between *D. sericea* and other specimens of *D. commixta*. In other respects he concluded the Cobar population was typical of *D. commixta*. Following the study of many more specimens that were seen by Staples it now appears that the eastern Australian populations are quite distinct from those in the west. There is a clear disjunction in the width of the outer sepals at fruiting and in the length: breadth ratio. The bracteoles at fruiting are larger in *D. halfordii* while the corolla, filaments and style are shorter.

**Etymology:** Named in honour of David Halford, colleague, whose taxonomic and editorial assistance in preparing an account of the family Convolvulaceae for the *Flora of Australia* has been greatly appreciated.

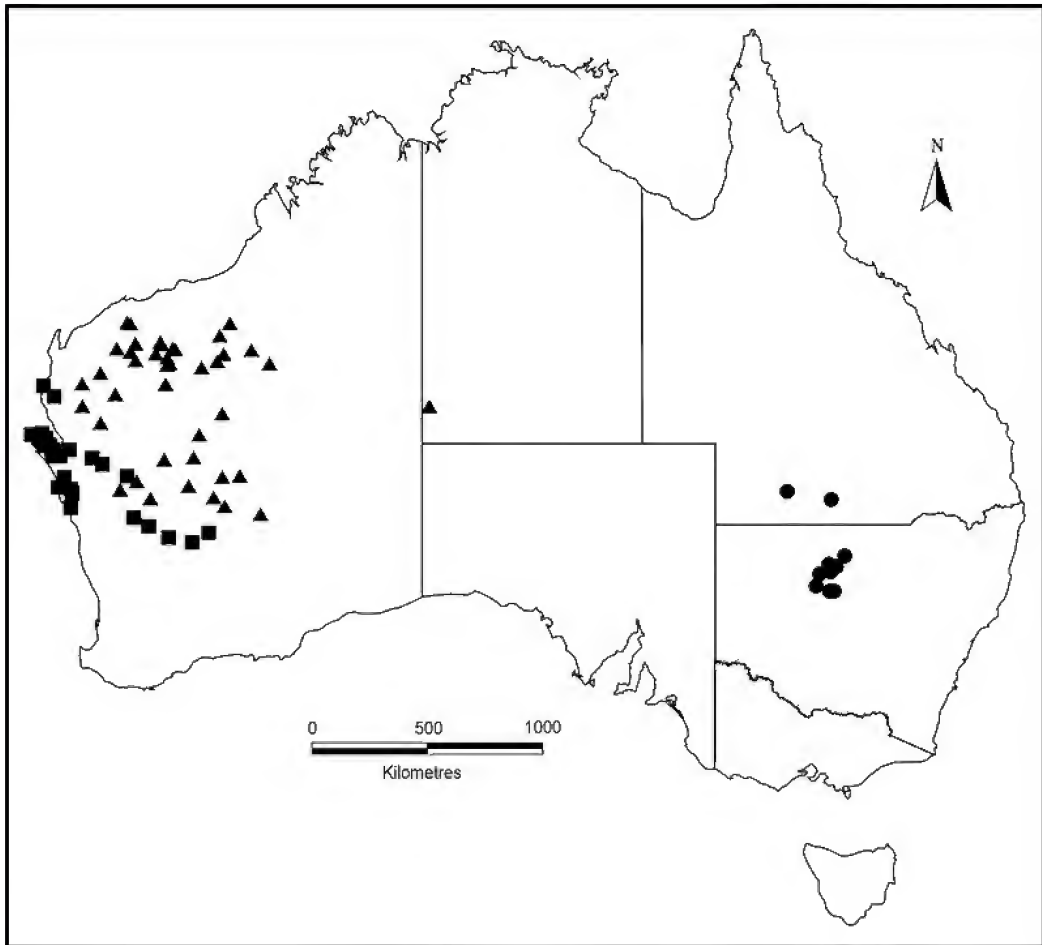
**Conservation status:** This species does not appear to be under threat and is given no conservation status in New South Wales. The populations in Queensland are rare and no collections have been made during the past 30 years.

### Acknowledgements

I gratefully acknowledge the assistance provided by David Halford. The curators of NSW and PERTH are thanked for providing loans for this study. I especially thank Dr Gordon Guymier, Director of the Queensland Herbarium, for providing space and facilities to enable me to continue my taxonomic research. I am also grateful to Brian Connell and Will Smith for the illustrations.

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**Map 1.** Distribution of *Duperreya commixta* (▲), *D. sericea* (■), *D. halfordii* (●).

# A conspectus of *Merremia* Dennst. ex Endl. (Convolvulaceae) in Australia with the addition of two species

R.W.Johnson

## Summary

Johnson, R.W. (2009). A conspectus of *Merremia* Dennst. ex Endl. (Convolvulaceae) in Australia with the addition of two species. *Austrobaileya* **8(1)**: 55–63. A conspectus and key to the species of *Merremia* growing in Australia is provided. A new species from Western Australia, *Merremia kimberleyensis* R.W.Johnson, is described. A combination, *Merremia incisa* (R.Br.) Hallier f., which until recently had been overlooked, is shown to be the correct name for a well-known taxon from northern Australia. Descriptions and distribution maps have been provided for both these species.

Key Words: Convolvulaceae, *Merremia*, *Merremia kimberleyensis*, *Merremia incisa*, Australian flora, new species, identification key

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## Introduction

*Merremia* Dennst. ex Endl. is a pantropical genus of more than 100 species (Staples *in press*). In preparing an account of *Merremia* for the *Flora of Australia* some changes to, and clarification of, the current taxonomy have resulted. This paper is a precursor to the account in that publication. Until recently, eleven species of *Merremia* have been formally recognised as occurring in Australia with a further two species recognised but undescribed. Ten of these also occur in Malesia (Ooststroom 1953). Six were regarded as native while the only described

endemic species was thought to be *Merremia davenportii* (F.Muell.) Hallier f.

The status of two additional species, which have been recognised for many years as distinct, is clarified below.

## Materials and methods

This paper is based on specimens mainly held at the Queensland Herbarium (BRI) and other herbaria as cited. Naturalised species are indicated \*.

## Key to Australian species of *Merremia*

- 1 Leaves palmately lobed to palmately compound with up to 7 lobes or leaflets . . . . . 2
- 1. Leaves simple, entire, toothed, pinnately lobed or hastate, neither palmately lobed nor compound . . . . . 8
- 2 Leaves palmately lobed to near the base but not palmately compound; leaflets 3–7 . . . . . 3
- 2. Leaves palmately compound with 3–5 leaflets . . . . . 4
- 3 Plant hairy; leaf lobes coarsely dentate to irregularly pinnately lobed; corolla white with a rose to purple throat, 3–4.5 cm long . . . . . 3. *M. dissecta*
- 3. Plant glabrous; leaf lobes entire; corolla yellow, 5–6 cm long . . . . . 12. *M. tuberosa*

- 4 Plant with dense stellate indumentum . . . . . **2. M. davenportii**
4. Plant glabrous or with simple hairs . . . . . 5
- 5 Peduncles glandular in the upper part, sometimes mixed with spreading hairs; sepals at flowering 3–8 mm. long; corolla to 2.5 cm long . . . **11. M. quinquefolia**
5. Peduncles glabrous or hairy, but not glandular; sepals longer, 7.5–25 mm long; corolla 2.5–5 cm long . . . . . 6
- 6 Leaflets 3, outer leaflets with a secondary lobe, so appearing 5, leaflets undulate to occasionally toothed; sepals glabrous, 12–15 mm long, sub-equal, acute . . . . . **8. M. kimberleyensis**
6. Leaflets 5, entire . . . . . 7
- 7 Outer sepals glabrous, 7–10 mm long, obtuse, much shorter than the inner; corolla 3–5 cm long. . . . . **10. M. quinata**
7. Outer sepals patently hirsute, 12–25 mm long, acute or acuminate, slightly longer than the inner; corolla 2–3.5 cm long . . . . . **1. M. aegyptia**
- 8 Leaves peltate . . . . . **9. M. peltata**
8. Leaves never peltate. . . . . 9
- 9 Corolla pink to mauve, glabrous; leaves initially ovate, cordate, dentate, becoming hastate with a long linear mid-lobe and shorter dentate basal lobes; sepals  $\pm$  equal in length . . . . . **7. M. incisa**
9. Corolla white, yellow or orange; leaves not as above; outer sepals shorter than inner . . . . . 10
- 10 Corolla 2–3.5 cm long, mid-petaline bands of corolla hairy externally; flowers in umbelliform cymes, rarely solitary . . . . . **13. M. umbellata**
10. Corolla 2 cm long or less, mid-petaline bands of corolla glabrous; flowers solitary or in few flowered cymes, not umbelliform . . . . . 11
- 11 Sepals slightly unequal in length; outer sepals 3–7 mm long, broadly ovate to orbicular or broadly spatulate, concave; inner sepals 4–8 mm long; capsule depressed-globular to broad-conical, wrinkled . . . . . 12
11. Sepals distinctly unequal in length; outer sepals 3–4 mm long, elliptic to oblong-elliptic or oblong, slightly concave or flat; inner sepals 4.5–6 mm long; capsule broad-ovoid to globular, smooth . . . . . **6. M. hirta**
- 12 Outer sepals 4–7mm long, broadly ovate to orbicular, emarginate, not or slightly mucronulate, usually hairy; inner sepals 6–8 mm long; corolla 1.5–2.5cm long; capsule depressed-globose, coarsely wrinkled; petioles appressed pilose, usually without tubercles . . . . . **4. M. gemella**
12. Outer sepals 3–4 mm long, broadly ovate to spatulate, broadly notched at the apex and distinctly mucronate, mucro directed outwards, usually glabrous; inner sepals 4–5 mm long; corolla 0.5–1 cm long; capsule depressed-globose or broadly conical, somewhat 4-angular, less coarsely wrinkled; petioles often with small tubercles . . . . . **5. M. hederacea**

## Conspectus of the Australian Species of *Merremia*

**1. \**Merremia aegyptia* (L.) Urb., *Symb. Antill.* 4: 505 (1910); *Ipomoea aegyptia* L., *Sp. Pl.* 1: 162 (1753); *Convolvulus pentaphyllus* L., *Sp. Pl.*, 2<sup>nd</sup> edn, 1: 223 (1762), *nom. illeg.*; *Ipomoea pentaphylla* Jacq., *Collectanea* 2: 297 (1789); *Merremia pentaphylla* (Jacq.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893). **Type:** America, Herb. C.Linnaeus 218.35 (lecto: LINN, *n.v.*, [microfiche IDC 177-5. 121: III. 2], *fide* Austin (1982: 84)).**

**Distribution:** Western Australia, Northern Territory; native of tropical America, now widespread throughout the tropics.

**2. *Merremia davenportii* (F.Muell.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893), as *M. davenporti*; *Ipomoea davenportii* F.Muell., *Fragm.* 6: 97 (1868), as *I. davenporti*. **Type:** “Davenport’s Ra.” [Davenport Ra., N.T.], *s.dat.*, *J.M.Stuart s.n.* (holo: MEL).**

**Distribution:** Western Australia, Northern Territory, Queensland; endemic species.

**3. \**Merremia dissecta* (Jacq.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893); *Convolvulus dissectus* Jacq., *Observ. Bot.* 2: 4, t. 28 (1767). **Type:** seeds from America, *Jacquín*, cult. in Vienna, *n.v.*, *fide* Austin (1979: 219).**

*Ipomoea sinuata* Ortega, *Nov. pl. descr. dec.* 84 (1798). **Type:** “Habitat in Insulâ Cubâ, ubi Aguinaldo vulgò vocatur”, *n.v.*, *fide* Ooststroom (1939: 302).

**Distribution:** Western Australia, Northern Territory, Queensland, South Australia; native of tropical and subtropical America, now widespread throughout the tropics.

**4. *Merremia gemella* (Burm.f.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893); *Convolvulus gemellus* Burm.f., *Fl. Indica* 46, t. 21, fig. 1. (1768); *M. gemella* var. *gemella*, Ooststr., *Blumea* 3: 302 (1939). **Type:** Java, *s. dat.*, *coll.*, (lecto: G [Herb. N.L.Burman], *n.v.*, *fide* Staples & Jacquemoud (2005: 448)).**

*Ipomoea flava* Benth., *Fl. Austral.* 4: 424 (1869). **Type:** tributaries of the Albert R., [Qld], 31 August 1856, *F.Mueller s.n.* (holo: MEL).

**Distribution:** Western Australia, Northern Territory, Queensland; also SE Asia and New Guinea.

**5. *Merremia hederacea* (Burm.f.) Hallier f., *Bot. Jahrb. Syst.* 18: 118 (1893); *Evolvulus hederaceus* Burm.f., *Fl. Indica* 77, t. 30, fig. 2 (1768). **Type:** Java, *s.dat.*, *D.Pryon s.n.* (holo: ?G [Herb. N.L.Burman]; *n.v.*, *fide* Ooststroom (1939: 306)).**

*Ipomoea chryseides* Ker Gawl., *Bot. Reg.* 4: t. 270 (1818); *Merremia chryseides* (Ker Gawl.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893). **Type:** “Koenig, India Orientalis”, *n.v.*, *fide* Ooststroom (1939: 302).

**Distribution:** Western Australia, Northern Territory, Queensland; also tropical Africa, SE Asia and New Guinea.

**6. *Merremia hirta* (L.) Merr., *Philipp. J. Sci.*, C. 7: 244 (1912); *Convolvulus hirtus* L., *Sp. Pl.* 1: 159 (1753); *M. hirta* var. *hirta*, Ooststr., *Blumea* 3: 311 (1939). **Type:** India, *s.dat.*, *Osbeck s.n.* (lecto: LINN [Herb. C.Linnaeus 218.56]; *n.v.*, [microfiche IDC 177-5. 122: III. 6], *fide* Merrill (1912: 245)).**

*Convolvulus caespitosus* Roxb., *Fl. Ind.*, 2: 70 (1824); *Merremia caespitosa* (Roxb.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893). **Type:** “Native of the dry lands of Dinagepore and Rungpore, from thence the seeds were sent, by Dr Carey, to the Botanic Garden at Calcutta”, *n.v.*, *fide* Ooststroom (1939: 307).

*Ipomoea linifolia* Blume, *Bijdr.* 721 (1826). **Type:** Moluccas, [Maluku, Indonesia], *n.v.*, *fide* Ooststroom (1939: 307).

**Distribution:** Queensland; also S and SE Asia and New Guinea.

**7. *Merremia incisa* (R.Br.) Hallier f., *Meded. Rijks-Herb.* 1: 21 (1910); *Ipomoea incisa* R.Br., *Prodr.*: 486 (1810); *Convolvulus incisa* (R.Br.) Spreng., *Syst. Veg.* 1: 609 (1824). **Type:** Northern Territory. Carpentaria. Island s [Morgans Island], 21 January 1803, *R.Brown* [Bennett no. 2751] (holo: BM [photo BRI]).**

*Ipomoea cinerascens* R.Br., *Prodr.*, 486 (1810); *Convolvulus cinerascens* (R.Br.) Spreng., *Syst. Veg.* 1: 609 (1824). **Type:** Northern Territory. North Coast. Island of α1 [Everett

Island], 4 March 1803, *R. Brown* [*Bennett no. 2752*] (holo: BM).

*Merremia* sp. B, of Wheeler & Marchant (1992: 756).

Perennial with a tap root and trailing stems, rooting at the nodes and twining towards the tips. Stems terete, herbaceous, densely to sparsely hairy or  $\pm$  glabrous; hairs spreading, tubercle-based, 0.25–0.7 mm long. Leaves simple, petiolate; petiole 0.5–7.5 cm long, blade on more basal leaves ovate, ovate-oblong, rarely narrowly ovate, 1–4.5 cm long, 1.2–4.5 cm wide, base truncate or obtuse to sub-cordate, apex obtuse or rounded and emarginate, rarely acute, mucronate, margin toothed, sometimes becoming shallowly lobed towards the leaf base, 4–7 teeth per side, becoming hastate in upper parts, 2.5–10 cm long, 0.2–5 cm wide with an entire to occasionally toothed linear to linear-oblong, rarely linear-triangular or narrowly elliptic terminal lobe, basal lobes dentate to 2 or 3 lobed, discolourous, densely to sparsely hairy or  $\pm$  glabrous on both sides, hairs as for the stem, midrib and 2 pair of veins at the base and 3–6 each side. Inflorescence axillary, 1, occasionally 2 per axil, cymose with 1–3 flowers, occasionally compound and scorpioid, bracteolate; peduncle 10–75 mm long, terete, hairs, including those on secondary branches, dense to scattered, rarely  $\pm$  glabrous; bracteoles opposite to sub-opposite, concave, linear to narrowly ovate or elliptic, 0.5–2 mm long, 0.4–1 mm wide, acute to truncate, apiculate, sparsely hairy to glabrous, margin hyaline, abscissing post-flowering; pedicel 3–12 mm, slightly dilated upwards, glabrous or rarely very sparsely hairy. Outer sepals ovate to ovate-oblong or ovate-triangular or elliptic, 5–7 mm long, 2–3.6 mm wide, extending to 9 mm long in fruit, obtuse, occasionally acute, apiculate, glabrous or with an occasional hair, glaucous, margin narrowly hyaline, smooth; inner sepals ovate to ovate-lanceolate, 5–7 mm long, 2.5–3.7 mm wide, extending to 9 mm long and 5 mm wide at fruiting, glabrous, acute to obtuse, apiculate, margin broadly hyaline. Corolla funnel-shaped, limb  $\pm$  entire, 10–15 mm long, 15–25 mm diameter, pink to mauve, occasionally white, with a deep yellow throat, glabrous; petals 10–17 mm long, 8–10

mm wide at the rim, tip rounded, emarginate to shallowly 2-lobed, apiculate, slightly erose, mid-petaline band with 5 darker longitudinal veins. Stamens 5, filaments very unequal, fused to the base of the corolla tube for 1–1.5 mm, free for 2–6 mm long, terete above, flattened and dilated downwards into a triangular basal fused area, with short cylindrical glandular hairs along the margin to just above the point of attachment, hairs to 0.5 mm long, base cylindrical, clear, tip conical, milky, glabrous above; anthers oblong to ovate-oblong, 1.2–2 mm long, 0.7–1 mm broad, base sagittate, basal lobes 0.3–0.5 mm long, apex rounded truncate to slightly emarginate, twisting at maturity; pollen tricolpate. Ovary ovoid *c.* 1.5 mm high 1.2 mm diameter, golden yellow, glabrous, 2-celled, 2 ovules per cell; style 1, slender, 3–3.5 mm long; stigma biglobular. Capsule globular to globular-ovoid with persistent style base, 6.5–8 mm long, 5–6.5 mm wide; seeds globular-ovoid, 4.3–4.7 mm long, 3.2–3.6 mm wide, reticulate-foveolate, dark brown to black, mostly glabrous with short hairs around the hilum and along the back and central ridge. **Fig. 1.**

**Additional selected specimens (52 specimens examined):** **Western Australia.** Piccaninny Creek Gorge, 15 km SE of Bungle Bungle Range, NE Kimberley, Apr 1985, *Blackwell BB5, BB122* (PERTH); tip of One Arm Point, Apr 1992, *Carter 533* (BRI); 19 km from Durack River crossing on Gibb River to Wyndham road, May 1986, *Clarkson 6553* (BRI); creek crossing, 5 km NW of Kalumburu Road junction on Mitchell River Station track, Jun 1987, *Edinger 377* (BRI, PERTH); Uwins Island, May 2003, *Handasyde TH1974* (BRI); 1 km above campsite on tributary of Prince Regent River, 19 km SE mouth, Jun 1984, *Kenneally 8900* (PERTH); SW side of Sir Graham Moore Island, Mar 1993, *Mitchell 2941* (BRI); King Leopold Ranges; hill between upper Lennard River & Eva Gorge, Apr 1988, *Sands 4619* (K, PERTH); near Prison Tree, 23 km S of Great Northern Highway on Moolchalabra Dam road, Apr 1983, *Wilson 4848* (NSW). **Northern Territory.** DARWIN & GULF: *c.* 40 miles [64 km] E of Mataranka, Mar 1972, *Byrnes 2574* (BRI, DNA); Magela Creek upper catchment, Apr 1995, *Cowie & Brennan 5640* (BRI, DNA); Arnhem Land, 19 km E of Jabiru, Apr 1989, *Johnson 4521* (BRI); Mt Brockman Outlier, 15 km SE of Jabiru, Apr 1989, *Johnson 4638* (BRI); 6 km W Roper Bar, Jun 1977, *Must 1510* (BRI, DNA); Buckingham River, E. Arnhem Land, Apr 1992, *Russell-Smith 8584* (BRI, DNA); 10 km from East Alligator River crossing on Oenpelli road towards Arnhem Land, Apr 1980, *Telford & Wrigley 7739* (BRI, CANB). **BARKLY TABLELAND:** 76 km S Elliott, Apr 1996, *Albrecht 7460* (BRI, DNA); Stuart Highway, North Hayward Creek, 58 km N of Tennant Creek, Apr 1983,

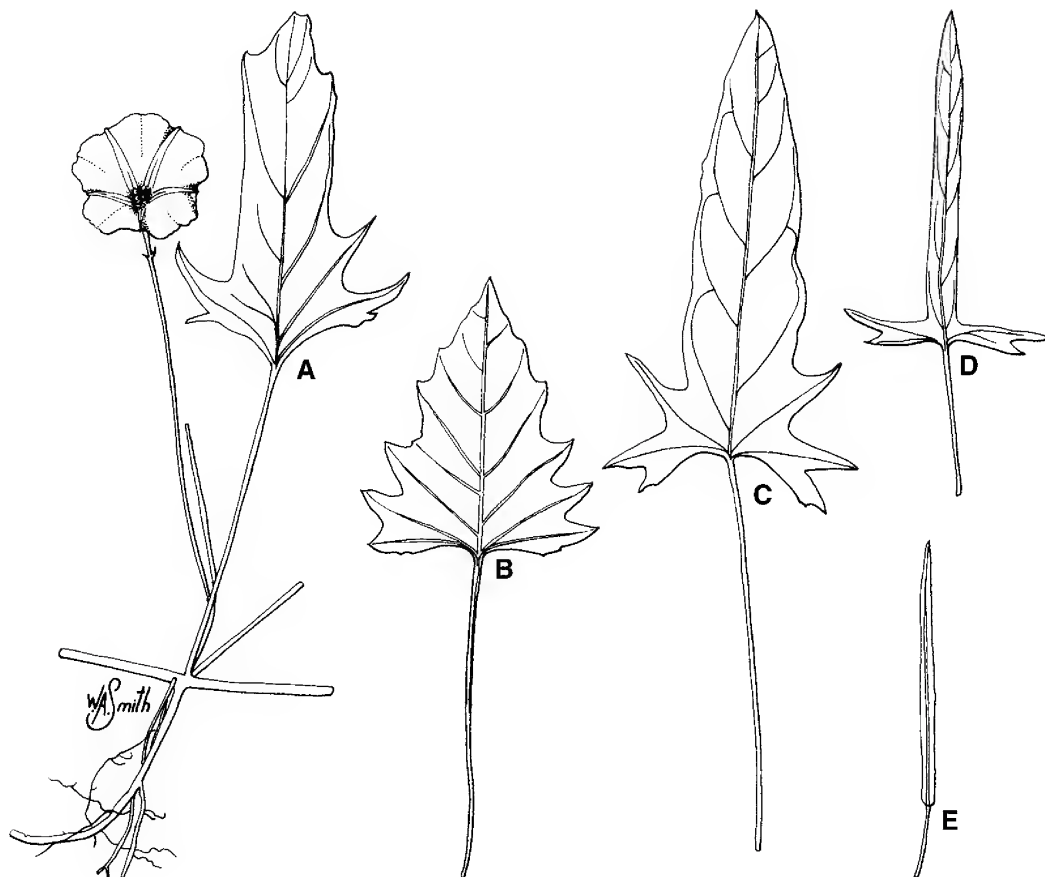


**Fig. 1.** *Merremia incisa*. A. flowering branch  $\times 1$ . B–E. variation in leaf shape from basal to terminal shoots  $\times 1$ . All from Johnson 4638 (BRI). Del. W.Smith.

*Wilson & Barker 4701* (NSW). **Queensland.** BURKE DISTRICT: Spring, c. 3 km SE of Musselbrook Gorge, Jun 1998, *Cumming 17664* (BRI); Amphitheatre, 41 km N of Musselbrook Mining Camp, May 1995, *Johnson & Thomas MRS832* (BRI).

**Distribution and habitat:** *Merremia incisa* occurs from north of Broome in Western Australia, across the northern part of the Northern Territory and extending into Queensland, north of Camooweal (**Map 1**). It is commonly associated with sandstone massifs often growing along ephemeral creeks and pools. It grows in open tussock or hummock grassy eucalypt woodlands on sandy soils, often containing stone or lateritic gravel.

**Phenology:** Flowering has been recorded from January to August with fruits occurring from March to August.

**Affinities:** *Merremia incisa* is a fairly distinct species and is perhaps most closely related to *M. hirta* (L.) Merr. It differs from the latter species in having coarsely toothed to lobed leaves and pink, not yellow flowers.

**Notes:** *Ipomoea incisa* has long been recognised as a coastal species growing in the Northern Territory. It was thought that inland specimens growing in sandstone areas belonged to a related but undescribed taxon. It was described as *Merremia* species (Arnhem Land) in Elliot & Jones (1993) and under *Merremia* sp. B. in the *Flora of the Kimberley Region* (Wheeler & Marchant 1992). Further

study of the coastal and inland populations suggests they are both part of the one taxon. Study of the pollen from the types of *Ipomoea incisa* and *I. cinerascens* indicated they had smooth colpate pollen and belonged to the genus *Merremia*. However, the new combination for *M. incisa* made by Hallier f. was overlooked in Australian literature and did not appear in the *Australian Plant Names Index* (Chapman 1991). As suggested by Benthams (1869), *I. cinerascens* appears to be a more villous form of *I. incisa*, and after studying the type material I would support his views.

**Etymology:** The specific epithet refers to marginal toothing and incision of the leaf blades on the type specimen.

**8. *Merremia kimberleyensis*** R.W.Johnson **species nova**, affinis *M. quinatae* (R.Br.) Ooststr. sed differt foliis tribus non quinque et sepalis acutis, subaequalibus non exterioribus obtusis et quam interioribus multis brevioribus. **Typus:** Western Australia. Kachana Station, [c. 40 km SE of Kununurra], 16°02'S, 128°56'E, 1 January 1995, *T.Handasyde TH.95 KAC 1* (holo: BRI [AQ532120 Sheet 2]; iso: BRI; PERTH04431685, *n.v.*).

Perennial with a tap root and trailing stems. Stems terete, herbaceous, glabrous. Leaves palmately compound, petiolate; petiole 1–11 cm long; blade ovate to broadly ovate in outline, 3–11 cm long, divided into 3 primary leaflets with each of the lateral leaflets with a secondary lobe towards the base, so the leaf appears 5-lobed, glabrous, terminal leaflet narrowly elliptic to elliptic, 3–10 cm long, 0.5–3 cm wide, tapering towards the base, apex acute, mucronate, margin undulate, toothed or occasionally shallowly lobed, with a mid rib and 12–16 pair of secondary veins, side leaflets 2.5–6 cm long, 4–12 mm wide, with a secondary lobe 1.5–3.6 cm long, c. 6 mm wide at the base. Inflorescence axillary, cymose, bracteolate; peduncle 1.5–10 cm long, thin, wiry, becoming recurved in fruit, bearing one, occasionally 2 or 3 flowers; bracteoles opposite to sub-opposite, very narrowly linear to subulate, 3–5 mm long, 0.7–1 mm wide at the base, acute, mucronulate, with

a thin hyaline margin, glabrous, persistent; pedicel 7–15 mm long, terete, slightly dilated upwards. Outer sepals narrowly ovate-oblong to oblong-elliptic, concave, 13–15 mm long, 5–7 mm wide, apex abruptly acuminate, acute, glabrous, thick with a thin hyaline margin, smooth, becoming chartaceous in fruit; inner sepals ovate to oblong-lanceolate or slightly deltoid, concave, 13–15 mm long, 7–8 mm wide, glabrous. Corolla funnel-shaped, 3.5–4 cm long, limb 3–3.5 mm diameter, white, slightly greenish at the base of the throat, lobed, glabrous; petals 4–4.5 cm long, 15–16 mm across at the limb, rounded apiculate at the tip, mid-petaline band with 5 translucent veins. Stamens 5, filaments fused for 6–7 mm from the base of the corolla tube, free for 9–12 mm, terete above, flattened and dilated downwards, hairy on the raised and angular fused part, hairs moderate to sparse, 0.1–0.3 mm long, basal cell cylindrical with a blunt terminal cell; anthers oblong to oblong-lanceolate, 3.25–3.65 mm long, 1.25–1.4 mm wide, sagittate, basal lobes 0.4–0.7 mm long, apex rounded to emarginate, splitting lengthwise at anthesis, but barely twisting. Ovary globular, 1.7–2 mm high, on a distinct disk, glabrous, 4-celled, 1 ovule per cell, style 1, 12–13 mm long, stigma biglobular, each 1.3 mm across. Capsule ovoid to globular, c. 8 mm across; seeds globular-ovoid, c. 5 × 4.75 mm, dark brown to black, densely pubescent.

## Fig 2.

**Additional specimens examined:** Western Australia. On E side of Wade Creek, c. 40 km W of Kalumburu Mission, May 1996, *Mitchell 4373* (BRI, PERTH); Sale River, May 1986, *Kenneally 9577* (PERTH); Kachana Station, about 50 km S of El Questro Homestead, Sep 1994, *Waser & Hengeler 01* (BRI, PERTH). Northern Territory. Spirit Hills area, c. 35 km SW of Bullo River Homestead, Mar 2009, *Cowie 12328* (BRI, DNA).

**Distribution and habitat:** *Merremia kimberleyensis* has been recorded from a few localities in the northern Kimberley from the Sale River and Wade Creek, to southwest of Kununurra, extending east into the Northern Territory (**Map 1**). It grows along creek banks, usually on sandy soils, often associated with sandstone.

**Affinities:** *Merremia kimberleyensis* is related to *M. quinata*. It differs in having three leaflets, not five leaflets, in having sub-equal



**Fig. 2.** *Merremia kimberleyensis*. A flowering branchlet  $\times 1$ . B inflorescence at fruiting  $\times 2$ . A. from *Handasyde TH.95 KAC 1* (BRI). B. from *Mitchell 4373* (BRI). Del. W.Smith.

acute sepals, with the outer obtuse and much shorter than the inner.

**Phenology:** Flowering and fruiting have been recorded in January and May.

**Etymology:** The specific epithet refers to the region in which the species is found.

**Notes:** This species was recognised as *Merremia* sp. A. in the *Flora of the Kimberley Region* (Wheeler & Marchant 1992) on the basis of a single specimen from Sale River in the west Kimberley.

**9. *Merremia peltata*** (L.) Merr., *Interpr. Herb. Amboin.* 441 (1917); *Convolvulus peltatus* L., *Sp. Pl.* 2: 1194 (1753); *Ipomoea peltata* (L.) Choisy, *Mém. Soc. Phys. Hist. Nat. Genève* 6: 452 (1834); *Operculina peltata* (L.) Hallier f., *Bot. Jahrb. Syst.* 16: 549 (1893); et 18: 119 (1893); *Merremia nymphaeifolia* Hallier f., *Verslag Staat Lands Plantentuin Buitenzorg* 127 (1896), *nom. illeg.* **Type:** illustration in G.E.Rumphius, *Herb. Amboin.* 5: 428, t. 157 (1750) (lecto, *fide* Merrill (1917: 441)).

*Ipomoea nymphaeifolia* Blume, *Bijdr.* 719 (1826). **Type:** “in fruticetis montanis et in convallibus umbrosis circa Buitenzorg”; *n.v.*, *fide* Ooststroom (1939: 352, 357).

*Ipomoea menispermacea* Domin, *Biblioth. Bot.* 89: 535 (1928). **Type:** Queensland. Cook DISTRICT: ap. flumen Harveys Creek, January 1910, K.Domin *s.n.* (holo: PR530538 [photo BRI]).

**Distribution:** Queensland; also tropical Africa, Malesia to Polynesia.

**10. *Merremia quinata*** (R.Br.) Ooststr., *Fl. Males.* ser. I, 4: 447 (1953); *Ipomoea quinata* R.Br., *Prodr.* 486 (1810); *Convolvulus quinatus* (R.Br.) Spreng., *Syst. Veg.*, 1: 590 (1824). **Type:** Northern Territory. North Coast. Island  $\alpha$  [Mallison Is., N.T.], 1 Mar. 1803, R.Brown [Bennett no. 2755] (holo: BM [photo BRI]).

*Ipomoea hirsuta* R.Br., *Prodr.* 486 (1810); *Convolvulus brownii* Spreng., *Syst. Veg.*, 1: 590 (1824) *nom. illeg.* **Type:** Northern Territory. Arnhem, north Bay [Melville Bay], 14 February 1803, R.Brown [Bennett no. 2756] (holo: BM [photo BRI]).

**Distribution:** Western Australia, Northern Territory, Queensland; also Malesia.

**Note:** An earlier but invalid combination for *Merremia quinata* was cited by Ooststroom (1948) referring to *Nova Guinea, n.s.* 5: 24; however, this was never published.

**11. \*Merremia quinquefolia** (L.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893); *Ipomoea quinquefolia* L., *Sp. Pl.* 1: 162 (1753). **Type:** illustration in Plukenet, *Phytographia*, t. 167, fig. 6 (1692) (lecto, *fide* Austin (1975: 182)).

**Distribution:** Queensland; native of tropical America, also naturalised in Africa and Malesia.

**12. \*Merremia tuberosa** (L.) Rendle, in W.T.Hiselton-Dyer, *Fl. Trop. Afr.* 4(2): 104 (1905); *Ipomoea tuberosa* L., *Sp. Pl.* 160 (1753). **Type:** Jamaica (lecto: LINN [Herb. C.Linnaeus 219.4], *n.v.*, [(microfiche IDC 177-5. A123: I. 2)], *fide* Austin (1975: 182)).

**Distribution:** Queensland; native of tropical America, widely cultivated in Old World tropics and occasionally naturalised.

**13. Merremia umbellata** (L.) Hallier f., *Bot. Jahrb. Syst.* 16: 552 (1893); *Convolvulus umbellatus* L., *Sp. Pl.* 1: 155 (1753). **Type:** illustration in Plukenet, *Phytographia*, t. 167, fig. 1 (1692) (lecto, *fide* Austin (1979: 221)).

**13a. \*Merremia umbellata** (L.) Hallier f. subsp. *umbellata*, Ooststr., *Fl. Males.* ser. I, 4: 449 (1953).

**Distribution:** Northern Territory, Queensland; native of tropical America and west tropical Africa.

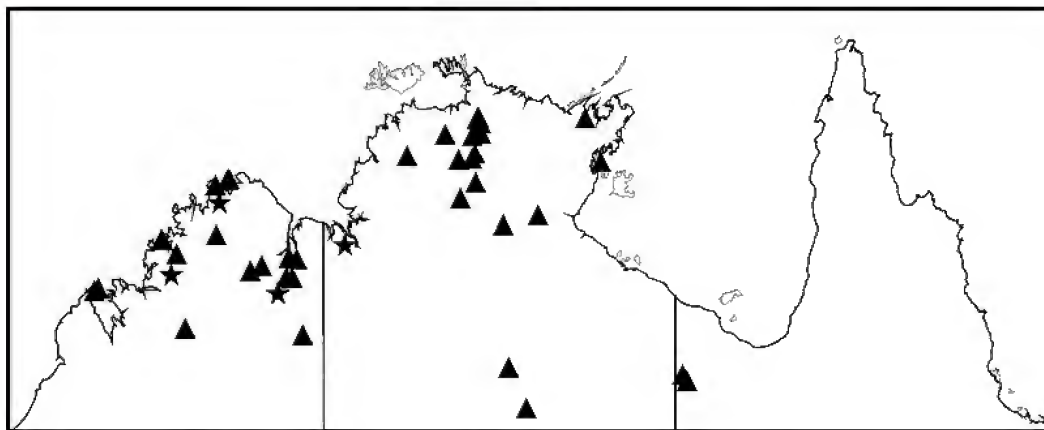
**13b. Merremia umbellata** subsp. *orientalis* (Hallier f.) Ooststr., *Fl. Males.* ser. I, 4: 449 (1953); *Merremia umbellata* var. *orientalis* Hallier f., *Verslag Staat Lands Plantentuin Buitenzorg* 132 (1896 '1895'). **Type:** East Indies, Java, Batavia, no specimen cited, *fide* Verdcourt (1963: 54).

*Convolvulus cymosus* Desr., in J.B.A.P.Lamarck, *Encycl.* 3: 556 (1792); *Ipomoea cymosa* (Desr.) Roem. & Schult., *Syst. Veg.* 16<sup>th</sup> edn, 4: 241 (1819). **Type:** from the East Indies, *n.v.*, *fide* Ooststroom (1939: 334, 341).

**Distribution:** Western Australia, Northern Territory, Queensland; also tropical E Africa, S and SE Asia to Polynesia.

#### Acknowledgements

I appreciate the support provided by Gordon Guymier, Director of BRI, which enables me to continue my taxonomic research. I thank David Halford who is working with me on the preparation of an account of *Merremia* for the *Flora of Australia* and Will Smith (BRI) for the illustrations.



Map 1. Distribution of *Merremia incisa* ▲, *M. kimberleyensis* ★

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# *Crotalaria inaequalis* A.E.Holland (Fabaceae), a new species from the Gulf Plains, Queensland

Ailsa E.Holland

## Summary

Holland, A.E. (2009). *Crotalaria inaequalis* A.E.Holland (Fabaceae), a new species from the Gulf Plains, Queensland. *Austrobaileya* **8**(1): 65–68. The new species, *Crotalaria inaequalis*, is described and illustrated, together with a map of its distribution. The distribution, habitat and conservation status of *C. inaequalis* is discussed. *Crotalaria inaequalis* is only known from the vicinity of Croydon in the Gulf Plains in northern Queensland. An amendment to the key by Holland (2002) to Australian species of *Crotalaria* is provided.

Key Words: Fabaceae, *Crotalaria inaequalis*, *Crotalaria smithiana*, *Crotalaria mitchellii*, Australia, Australian flora, Queensland flora, taxonomy, new species, identification key

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## Introduction

The genus *Crotalaria* L. includes more than 600 species worldwide with 18 species currently considered to be native to Australia (Holland 2002). Eleven of these species occur in north-western Queensland: *Crotalaria dissitiflora* Benth. (Section *Hedriocarpae* Wight & Arn.); *C. calycina* Schrank, *C. humifusa* Graham ex Benth., *C. montana* Heyne ex Roth, *C. brevis* Domin, *C. ramosissima* Roxb. and *C. crispata* F.Muell. ex Benth. (all section *Calycinae* Wight & Arn.); *C. aridicola* Domin and *C. medicaginea* Lam. (section *Dispermae* Wight & Arn.); *C. novae-hollandiae* DC. and *C. verrucosa* L. (section *Crotalaria*). Of these, *Crotalaria dissitiflora*, *C. brevis*, *C. crispata*, *C. aridicola* and *C. novae-hollandiae* are endemic to Australia. All of these species are widely distributed and considered not to be threatened.

In 1997, a specimen of an unknown *Crotalaria* was collected by Jenny Milson from the Croydon area in the Gulf Plains bioregion, an unique area of grassy woodland on sandy hills. It was again collected in 1999, 2003 and 2004, found growing mainly in disturbed areas, suggesting a possible introduction. However, after investigation, and assistance

from Dr Roger Polhill who checked material held at the Royal Botanic Gardens Kew, it was clear that it was indeed a native species. In the last two years Keith McDonald has collected several more specimens and it is now possible to describe this new endemic species, which is restricted to this area of unique habitat.

## Taxonomy

***Crotalaria inaequalis* A.E.Holland, species nova** *C. smithiana* A.T.Lee maxime affinis. Ab illo habitu prostrato, quoque pari stipularum inaequimagno etiam stipulis ovatis obovatisve et lobis calycis tubum duplo superans, differt. **Typus:** Queensland. BURKE DISTRICT: Croydon Cemetery, 2.1 km S of Croydon, Apr 2009, *K.R.McDonald* KRM8383 (holo: BRI [AQ747613]; iso: CNS, CANB, DNA, PERTH, *K distribuendi*).

Prostrate herb with a perennial tap root. Stems to 70 cm long, striate, densely villous, the hairs spreading to retrorse, c. 1 mm long, white or light brown. Leaves simple, blade obovate to narrowly oblong, variable in size, 6–41 mm long, 3–21 mm wide, obcordate or emarginate at apex, tapered at base; upper surface dark green, sparsely to moderately villous; lower surface paler, moderately to densely villous. Petiole 1–3 mm long, not articulate. Stipules in unequal pairs, sessile, variable in size, villous, entire, often persisting after leaf fall. Larger stipule (of pair) slightly longer and

wider initially and increasing in size over time, ovate to obovate or oblique, 3–12 mm long, 1.8–8 mm wide, the acute to acuminate apex becoming obliquely set to one side as the blade expands. Smaller stipule ovate or elliptic to somewhat falcate, acuminate, 1–3.5 mm long, 0.5–1.5 mm wide. Racemes leaf opposed, determinate, 3–9 cm long, villous, with up to 10 flowers spaced unevenly along the rhachis and spreading (in the same plane) at *c.* 90° from the prostrate rhachis. Bracts, bracteoles and pedicels villous; bracts sessile, ovate, acuminate, 2–4 mm long, 1–2.2 mm wide, persistent; bracteoles filiform, inserted variously on the pedicel mostly in the lower half, caducous; pedicels 3–8 mm long at anthesis, slightly increasing in length as fruit develops. Calyx 5–7.5 mm long, deeply divided into 5 subequal lobes, villous, persistent; tube campanulate 1.5–2.3 mm long, 5-veined; lobes more than twice the length of the tube, narrowly triangular, acuminate, 3.2–5.7 mm long, 1–2 mm wide at base, flat. Corolla longer than calyx, yellow, the outer surface stained reddish orange, sometimes darker at the tips; standard suborbicular, strongly reflexed at maturity, 11–12 mm long and wide, rounded with a small mucro at apex, with two horizontal folds near base, and a few hairs along the midrib on the outer surface; claw 1–2 mm long and *c.* 1.5 mm wide, ciliate; wings oblong, 9–10 mm long and *c.* 5 mm wide, more or less equalling the keel, rounded at apex; upper margin convex with a slight fold at the base; lower margin more or less straight; claw slightly twisted, 1–2 mm long; keel sharply upturned by *c.* 90° from the base, 10–11 mm long, 6–7 mm wide; lower margin open along the rounded base, ciliate along the edges; upper margin sinuate with a slight pocket towards base; beak 7–9.5 mm long, twisted by *c.* 180° at the apex; claw *c.* 2 mm long, ciliate. Stamens with long anthers 1.2–1.4 mm long, short anthers *c.* 0.3 mm long. Style sharply reflexed upwards, hairy on the upper side for *c.* 1/3 of the length below the stigma. The style elongating over time, and protruding from the base of the keel along with several of the stamens. Pods spreading (in same plane) at *c.* 90° to the rhachis, subsessile, inflated, oblong-clavate, 20–26 mm long, 8–12 mm wide, glabrous, light brown when mature,

indistinctly veined, tapered at the base and with a 1–2 mm mucro (persistent style base) at apex. Ovules 8–12, usually with 6 seeds developing. Seeds oblong-reniform, flattened, 3–4.5 mm long and wide, yellowish-brown, smooth. **Fig. 1.**

**Additional specimens examined: Queensland.** BURKE DISTRICT: 2.5 km by road, W of Croydon, Mar 2007, *McDonald KRM6255* (BRI); Near Croydon Cemetery, 2 km S of Croydon, Feb 2007, *McDonald KRM6061* (BRI); Lake Belmore, near Croydon, Aug 2003, *Fensham 4917* (BRI); 32 km by road S of Croydon towards Claraville Station, Sep 2006, *McDonald KRM5751* (BRI); Warrigal Creek, 16 km along Richmond road from Prospect Station road junction, Mar 2008, *McDonald KRM7563* (BRI, CNS); *c.* 10 km S of Glenora Station, N of Gilberton, Site CRC45, Jun 1999, *Fox IDF207* (BRI, CNS); Fog Creek Station, near Fog Creek, *c.* 15 km N of homestead, 180 km N of Richmond, Apr 2004, *Kahler TH7973* (BRI); Taldora Homestead, 150 km N of Julia Creek, just E of Saxby Roundup grounds, Aug 2004, *Laffey AZ11622* (BRI); 4 km N of Arizona House, Apr 1997, *Milson JM1274* (BRI).

**Distribution and habitat:** The species occurs in low open woodland of *Eucalyptus*, *Corymbia*, *Lysiphyllum* and *Acacia julifera*/*Acacia torulosa*/*Acacia leptostachya* with grass or herb understorey on sand, often on alluvium in loose sand, in the vicinity of Croydon. It is found in areas disturbed by fire or flooding. It is common in the Croydon cemetery which is disturbed regularly by slashing (**Map 1**).

**Phenology:** This species flowers sporadically from February to June, probably in response to monsoonal rain.

**Notes:** This species is characterised by the unequal stipule pairs, the prostrate habit, and the large flowers and pods. It appears to be related to the shrubby *Crotalaria smithiana* which has similar leaves, flowers and pods. It has been confused with *Crotalaria humifusa*, another prostrate species which, however, has much smaller flowers and pods. There are no similar species occurring in the area. Many Australian species of *Crotalaria* are known to be toxic (Everist 1981); however, this species has not been investigated.

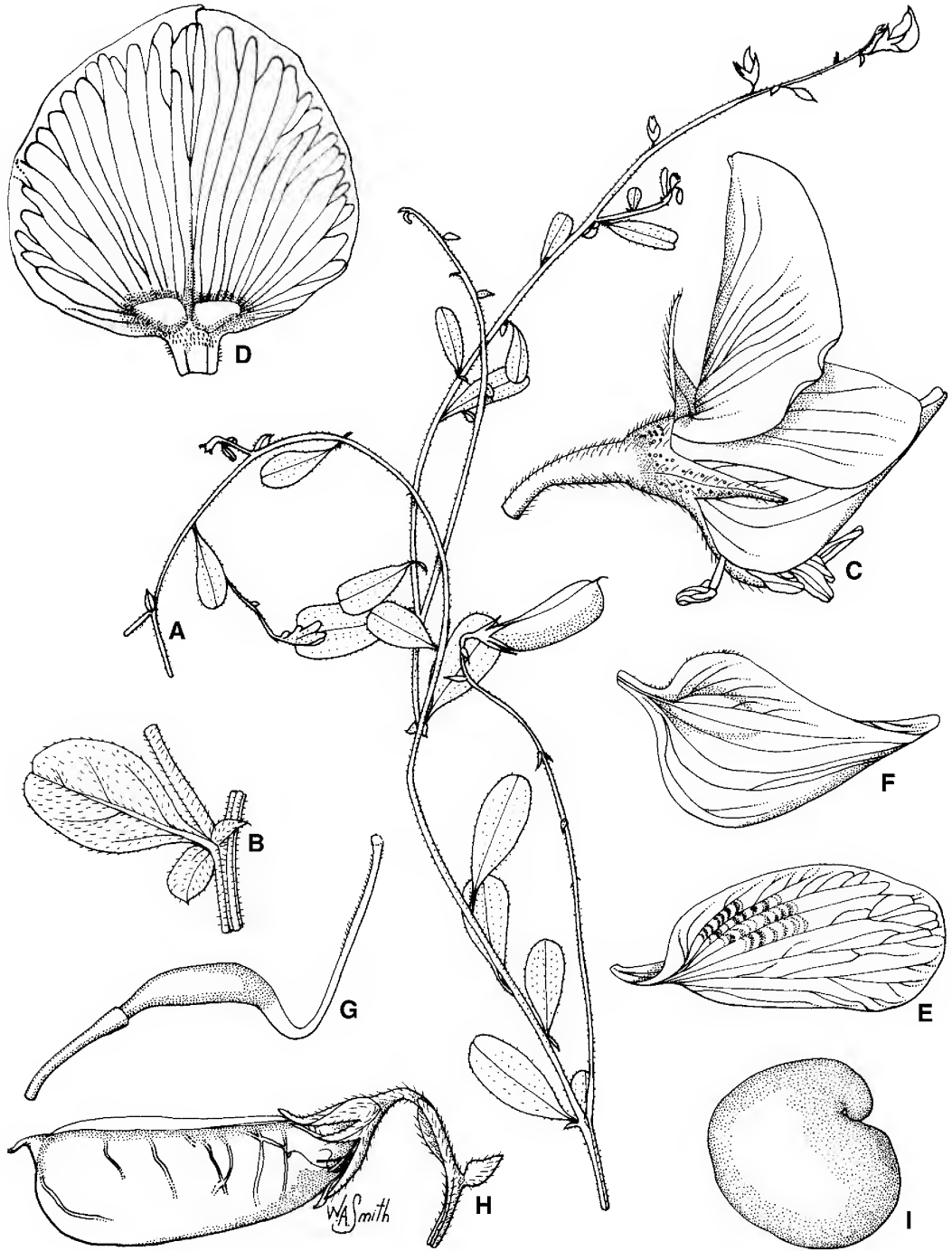


**Fig. 1.** *Crotalaria inaequalis*. A. habit  $\times 0.8$ . B. Leaf showing unequal stipules  $\times 3$ . C. flower  $\times 4$ . D. standard petal (inside)  $\times 4$ . E. wing petal (inside)  $\times 4$ . F. keel  $\times 4$ . G. ovary, style and stigma  $\times 3$ . H. pod  $\times 2$ . I. seed  $\times 6$ . All drawn from McDonald KRM7563 (BRI). Del. W. Smith.

The key to species in Australia as presented in Holland (2002) is amended after couplet 19 by inserting:

- 19a** Stipules in unequal pairs, one much larger than the other; calyx 5–7.5 mm long and calyx lobes subequal and more than twice the calyx tube . . . . . ***C. inaequalis***
- 19a.** Stipules similar to each other; calyx either more than 7 mm long or if shorter, then calyx lobes unequal or lobes less than twice the length of the calyx tube . . . . . 20

**Conservation status:** This species occurs in the northern Claraville Plains province of the Gulf Plains bioregion, between 18°11' and 19°30'S and 141°17' and 143°05'E, with an extent of occurrence of about 1000 km<sup>2</sup>. It has recently been located in reasonable numbers in the Croydon area and appears to respond positively to disturbance either from fire or flood, and in some areas, to mechanical slashing or light grading (K.R.McDonald, *pers. comm.* May 2009). There are no identified threats to the species. A conservation status of least concern is therefore recommended.

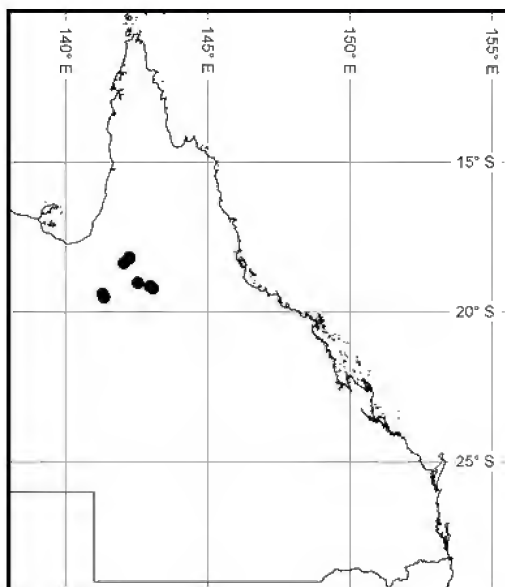
**Etymology:** This species is named for the unequal stipule pairs that are the distinguishing feature.

#### Acknowledgements

I thank Keith McDonald (Department of Environment and Resource Management) for collecting plant material, habitat information and comments, Roger Polhill (Royal Botanic Gardens, Kew) for his search of the overseas material in determining the status of the species, Peter Bostock for the Latin diagnosis and Will Smith for the illustrations.

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**Map 1.** Distribution of *Crotalaria inaequalis*

# *Coelospermum purpureum* Halford & A.J.Ford (Rubiaceae), a new species from north-east Queensland

D.A. Halford<sup>1</sup> & A.J. Ford<sup>2</sup>

## Summary

Halford, D.A. & Ford, A.J. (2009). *Coelospermum purpureum* Halford & A.J.Ford (Rubiaceae), a new species from north-east Queensland. *Austrobaileya* 8(1): 69–76. *Coelospermum purpureum* Halford & A.J.Ford is described, illustrated and diagnosed against allied species. Notes on habitat, distribution, and conservation status are provided. A key to the species of *Coelospermum* in Australia is presented.

Key Words: *Coelospermum purpureum*, *Coelospermum*, Rubiaceae, Australian flora, Queensland flora, taxonomy, identification key, new species

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## Introduction

Fertile collections of the species here described as *Coelospermum purpureum* have been in the Queensland Herbarium (BRI) since the 1950s and originally were tentatively identified as *Randia* sp., assumingly as it is a tall shrub or small tree, and later (1990s) listed as *Randia* sp. (Boonjee L.W.Jessup+ GJM264) (Reynolds & Halford 1997). Puttock & Quinn (1999) were not aware of the material and it was not assessed as part of their study of the generic placement of the Australian species of *Randia* L. *sens. lat.* The material was brought to the first author's attention in 2006 by Dr Aaron Davis (K) who was of the opinion that its affinities possibly laid with *Prismatomeris* Thw.

*Prismatomeris* consist of fifteen species of shrubs and small trees that occur in South-east Asia (Johansson 1987) and was initially placed in the Rubiaceae tribe *Morindeae* Miq. (Hooker 1873). Recent anatomical and molecular studies strongly support the separation of *Prismatomeris* and several closely related genera (*Gentingia* J.T.Johanss. & Wong, *Motleyia* J.T.Johanss. and *Rennellia* Korth.) from the *Morindeae sens. str.* (Igersheim & Robbrecht 1993; Razafimandimbison *et al.* 2008).

The current authors have critically examined the pollen, flowers and fruits of *Randia* sp. (Boonjee L.W.Jessup+ GJM264) and concluded that it belongs in the Rubiaceae tribe *Morindeae sens. str.* and is mostly correctly placed in the genus *Coelospermum* Blume. Johansson (1988) distinguished *Coelospermum* from *Morinda* mainly on pollen-morphological characters 'the lumina of the sexine being much larger in *Coelospermum* with few or numerous luminal processes'. Leaf material of *Randia* sp. (Boonjee L.W.Jessup+ GJM264) was sent by the second author to Dr Sylvain Razafimandimbison (Bergius Foundation, Stockholm) so it could be included in his molecular (*rps16* intron, *trnT-F*, *nrETS* and *nrITS*) studies of the *Morindeae sens. str.* He found that the sample grouped with the other sequenced *Coelospermum* species and resolved as sister to the Australian *C. paniculatum* var. *syncarpum* J.T.Johanss. (Razafimandimbison *et al.*, unpublished data).

The genus *Coelospermum* is distributed throughout South-east Asia, Malesia (including New Guinea), Melanesia and Australia and currently comprises eight species (Johansson 1988; Halford & Ford 2004), most of which are lianas. Two species of *Coelospermum* are recorded for Australia (both lianas), namely *C. paniculatum* F.Muell. and *C. dasylobum*

Halford & A.J.Ford (Forster & Halford 2007). A third Australian species of *Coelospermum*, from north-eastern Queensland, is here described.

### Materials and methods

The study is based upon the examination of herbarium material from BRI and CNS (formerly QRS) with field observations by the second author. All specimens cited have been seen by one or both authors. Measurements of the floral parts and fruits of *Coelospermum purpureum* are based on material preserved in 70% ethanol. Common abbreviations in the specimen citations are: L.A. (Logging Area), N.P./R. (National Park/Reserve), S.F.R. (State Forest Reserve) and T.R. (Timber Reserve). The abbreviation RE in the distribution and habitat notes refers to Regional Ecosystem, descriptions of which can be viewed at (in this case), [www.epa.qld.gov.au/projects/redd/landzone.cgi?bioregion=7](http://www.epa.qld.gov.au/projects/redd/landzone.cgi?bioregion=7).

Extent of occurrence estimates were derived from the validation of original collection localities. These data points were loaded into ESRI ArcView 3.2 and the draw polygon feature was used to calculate the area between the points. The area of occupation estimates were principally derived from a digital Regional Ecosystem map supplemented by the second author's knowledge of vegetation types and habitats within the Wet Tropics bioregion (referred to as the Wet Tropics hereafter) (Environment Australia 2005).

### Taxonomy

*Coelospermum purpureum* Halford & A.J.Ford, **species nova** similis *C. crassifolio* J.T.Johanss. (a Nova Caledonia) quod saepe format fruticem inflorescentiis paucifloribus floribus pro parte maxima pedicellatis et fructibus pro parte maxima drupis simplicibus praeditis autem foliis tenuioribus atroviridibus in pagina adaxiali marginibus planis (vice foliorum crassorum viridium vel flavoviridium marginibus reflexis) et tubis corollarum longioribus (8–13 mm longis vice 3–7 mm) differt. *Coelospermum purpureum* est plerumque frutex usque arbor parva speciebus ceteris Australiensibus (*C. dasylobo*

Halford & A.J.Ford et *C. paniculato* F.Muell.) dissimile. Differentiae inter *C. dasylobum*, *C. paniculatum* et *C. purpureum* in Tablo 1 instruuntur. **Typus:** Queensland. COOK DISTRICT: Daintree National Park, SE ridge of Mt Hemmant, above Noah Creek, 5 June 2007, A.J. Ford AF5084 & R. Jensen (holo: BRI, iso: CNS; L, MO, NSW *distribuendi*).

*Randia* sp. (Boonjee L.W.Jessup+ GJM264) (Forster & Halford 2007: 179).

*Randia* sp. (Boonjee BG5345) (Hyland *et al.* 2003).

*Randia* sp. (Boonjee) (Cooper & Cooper 2004: 451).

**Illustrations:** Hyland *et al.* (2003); Cooper & Cooper (2004: 451), as *Randia* sp. (Boonjee).

Bushy shrub to 5 m high (usually umbrella-like) or small tree to 10 m high, stem diameters to 8 cm dbh, glabrous. Bark brown, lacking distinctive features. Wood yellowish, roots brownish. Branchlets laterally compressed (elliptic in transverse section), becoming  $\pm$  terete with age; bark on old twigs somewhat flaky, leafy twigs varnished to smooth, purple when fresh; flattened slightly at nodes; raphides present. Leaves petiolate, opposite; stipules interpetiolar, sheathing, 1.5–2 mm long, produced into a narrow triangular lobe, purple when fresh, glabrous, fragmenting as node thickens; petioles 7–15 mm long, purple when fresh; blades discolorous, leathery and thin, narrow-elliptic, sometimes narrow-obovate, 7–15 cm long, 1.9–5 cm wide; adaxial surface shiny or glossy, dark green; abaxial surface much paler than adaxial surface; venation brochidodromous with 5–7 lateral veins per side of midvein; lateral veins slightly raised on both surfaces, slightly more prominent on abaxial surface; tertiary venation not raised; apex acuminate; base cuneate; margins entire; domatia absent. Inflorescence terminal, 2–4-flowered umbel-like, pedunculate dichasium (rarely with an additional 3-flowered umbel-like cyme); peduncle 10–36 mm long, glabrous, terete; bracts *c.* 0.5 mm long, glabrous. Flowers faintly perfumed, (3)4(5)-merous, bisexual; pedicel 7–18 mm long (rarely absent), laterally compressed (elliptic in transverse section),

swollen distally. Calyx tube (including hypanthium) green, 3.5–4.2 mm long, 1.7–2.5 mm across, truncate-urceolate, glabrous, with scattered colleters on rim; calyx teeth irregular, triangular, 0.1–0.2 mm long. Corolla valvate, clavate in bud, deciduous, white at anthesis becoming cream or yellowish-white with age, glabrous on abaxial surface; tube 8–13 mm long,  $\pm$  cylindrical, slightly widened at the mouth and constricted at base, fenestrated by short longitudinal splits in lower third of tube, glabrous and papillose on adaxial surface in proximal half but hairy and smooth distally; hairs simple, *c.* 0.5 mm long, white, spreading; lobes spreading and recurved distally at anthesis, narrow-lanceolate or very narrow-elliptic, 9.5–13 mm long, 2–2.5 mm wide, glabrous, acute and  $\pm$  cucullate at apex. Stamens always exserted; staminal filaments 2.5–3.1 mm long in long-styled flowers, 5–6 mm long in short-styled flowers, inserted at the sinuses of the corolla lobes; anthers dorsifixed, versatile, linear, 5.8–6.8 mm long, glabrous, with a short mucro at the tip, dehiscing laterally through longitudinal slits. Disc annular, entire, *c.* 0.5 mm high, glabrous. Ovary 2-celled, biovulate; ovules *c.* 0.7 mm long. Long styled flowers with style exserted, 9.7–16 mm long, glabrous; stigma bifid, with spreading lobes 4.5–7 mm long, adaxial surface and margin wrinkled, abaxial surface glabrous. Short styled flowers with style inserted, 6.6–6.9 mm long, glabrous; stigma bifid, with erect lobes 3.8–3.9 mm long, smooth. Fruit a drupe, subglobose to pyriform (due to fleshy apex of pedicel/stipe),  $\pm$  laterally compressed, shiny, 14–19 mm long and 11–17 mm across, yellow-orange when ripe, glabrous, persistent calyx tube present but not prominent on surface; pericarp firm, and leathery; mesocarp fleshy, containing four pyrenes. Pyrenes oblong-elliptic in outline, 7–11 mm long, 5–6 mm wide, 2–3.5 mm thick, 1-seeded; endocarp cartilaginous, pale brown, rugose, with an open basal marginal groove. Seed 7–10 mm long, 3–4 mm wide, *c.* 1 mm thick, thickened at one end and tapering to a thin wedge at the other end, with an equatorial ring; testa membranous, dark brown, extended into a flange/wing at one end; endosperm corneous, white; embryo 3.7–5 mm long, straight, surrounded by a clear

and sticky gelatinous membrane; cotyledons 1.6–2 mm long, 0.7–1.1 mm wide, thin, *c.* twice as broad as the radicle; radicle 1.9–3 mm long, 0.5–0.6 mm wide. Germination epigeal (phanerocotylar); cotyledons ovate, 22–31 mm long and 14–18 mm wide, base cordate-obtuse. **Fig 1.**

**Additional selected specimens examined: Queensland.**

COOK DISTRICT: N.P.R. 212, Mt Finnigan, ridge near Mt Shipton, Oct 1999, *Ford 2290* (CNS); N.P.R. 133, summit of Mt Sorrow ridge walk, site 2, Nov 2000, *Ford 2532 et al.* (CNS); Parish of Alexandra, Little Cooper Creek, Oct 1994, *Gray 5810* (CNS); N.P.R. 133, Daintree, end of Turpentine road, Little Cooper Creek, Nov 2002, *Ford AF3680 et al.* (BRI, CNS); Thornton Peak, west slope, Sep 1992, *Le Cussan 143* (CNS); upper slopes western fall, Thornton Peak, Sep 1986, *Tracey 14992* (CNS); S.F.R. 310 Swipers L.A., Nov 1955, *White [AFO]01317* (BRI, CNS); S.F.R. 310, Windin L.A., Oct 1974, *Hyland 7729* (CNS); Stockwellia site, Boonjee, Jun 1995, *Cooper 944 & Cooper* (CNS); T.R. 1230 Bartle Frere, Boonjee L.A., Nov 1991, *Hyland 14306* (CNS); S.F.R. 755 Boonjee LA (on Bartle Frere Track), Dec 1972, *Hyland 6594* (CNS); SFR 755 Bartle Frere, Boonjee L.A., Mar 1993, *Gray 5645* (CNS); mid slopes western fall Bartle Frere track, Oct 1985, *Tracey 15546* (CNS); S.F.R. 1230 Bartle Frere, Boonjee L.A., Oct 1991, *Gray 5345* (CNS); T.R. 1230, Boonjee L.A., Nov 1987, *Hyland 13327* (CNS); S.F.R. 755 Bartle Frere, Gosschalk L.A., *Gray 6220* (CNS); S.F.R. 755 Bartle Frere, Coolamon L.A., Nov 1990, *Hyland 14085* (BRI, CNS); on the old pack track from Towalla to Chuchabba, Nov 1991, *Jago 720* (CNS); N.P.R. 904 Wooroonooran, along track to Towalla Mine, Sep 2000, *Ford AF2446* (BRI); S.F.R. 755, Elinjaa L.A., Jun 1974, *Irvine 911* (CNS).

**Distribution and habitat:** *Coelospermum purpureum* is endemic to the Wet Tropics in north-eastern Queensland, where it is currently known to occur from the Cooktown area (Mt Finnigan) to the Topaz-Towalla area on the eastern edge of the Atherton Tableland, near Mt Bartle Frere (**Map 1**). However, within this large range *C. purpureum* is confined to three distinctive and disjunct populations (from north to south):

1. Mt Finnigan area
2. Cape Tribulation area, bounded roughly by Mt Sorrow, McDowall Range, Thornton Peak and Mt Hemmant
3. Towalla – Topaz area, including Mt Bartle Frere.

This species occurs in predominantly the wetter and more mountainous notophyll vine-forests/rainforests on soils derived

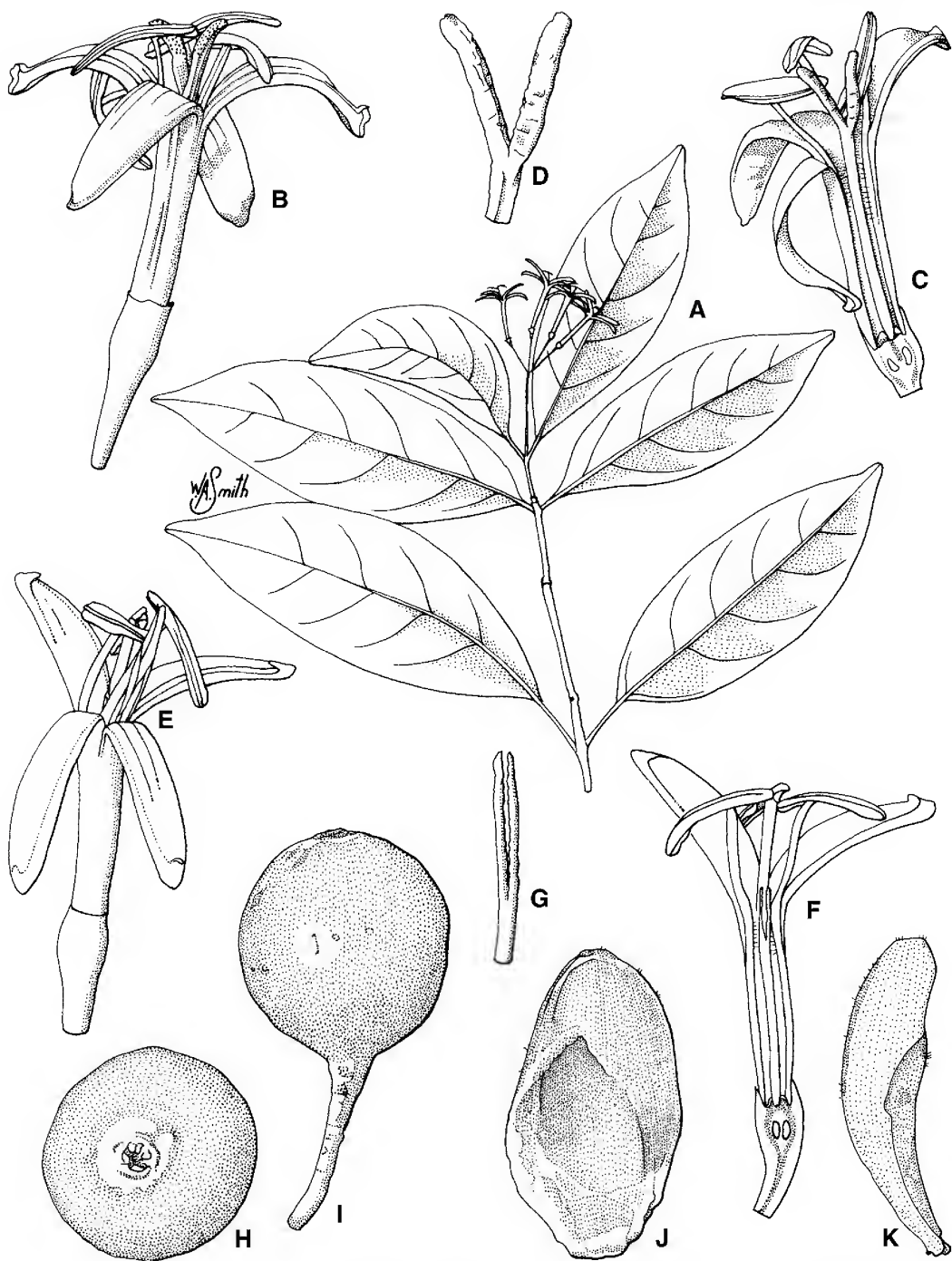


**Fig. 1.** *Coelospermum purpureum*. A. branchlet with inflorescence  $\times 0.6$ . B. flower (long styled) at anthesis  $\times 3$ . C. section of flower (long styled) at anthesis  $\times 3$ . D. stigma (long styled)  $\times 6$ . E. flower (short styled) at anthesis  $\times 3$ . F. section of flower (short styled) at anthesis  $\times 3$ . G. stigma (short styled)  $\times 6$ . H. face view of fruit  $\times 2$ . I. lateral view of fruit  $\times 2$ . J. adaxial view of pyrene  $\times 4$ . K. lateral view of pyrene  $\times 4$ . A from Forster PIF21984 *et al.* (BRI); B–D from Gray 5345 (CNS); E–G from Hyland 13327 (QRS); H–I from Ford AF5084 & Jensen. (BRI); J–K from Ford AF3680 *et al.* (BRI). Del. W.Smith.

from granite, fine grained metasediments (including mudstone) and basalt. However, it is more commonly encountered on metasedimentary and granitic substrates, with occurrences on basalt being rare. In addition, a specimen has also been recorded as occurring in closed fernland (Hunter 2192). Although it occurs over a disjunct geographic area common canopy species include: *Balanops australiana* F.Muell., *Beilschmiedia oligandra* L.S.Sm., *Ceratopetalum virchowii* F.Muell., *Cryptocarya lividula* B.Hyland, *Elaeocarpus elliffii* B.Hyland & Coode, *E. foveolatus* F.Muell., *Flindersia bourjotiana* F.Muell., *Flindersia pimenteliana* F.Muell., *Halfordia kendack* (Montrouz.) Guillaumin, *Musgravea stenostachya* F.Muell., *Sloanea australis* subsp. *parviflora* Coode, *Syzygium endophloium* B.Hyland and *Waterhousea unipunctata* B.Hyland. Common small trees and shrubs throughout most of its range include: *Apodytes brachystylis* F.Muell., *Bobea myrtoides* (F.Muell.) Valetton, *Chionanthus axillaris* R.Br., *Crispiloba disperma* (S.Moore) Steenis, *Pittosporum rubiginosum* A.Cunn., *Polyscias australiana* (F.Muell.) Philipson, *Psychotria* sp. (Danbulla S.T.Blake 15262), *Schistocarpea johnsonii* F.Muell., *Symplocos* sp. (Boonjie B.P.Hyland 2753) and *Wilkiea angustifolia* (F.M.Bailey) J.R.Perkins. Altitudinal range, from existing specimens, is 80–1360 m although there appears to be a preference between 500 m and 800 m.

*Coelospermum purpureum* has been collected or reliably reported in the following REs: 7.8.2a (rarely); 7.11.12a (commonly), 7.11.12c (occasionally), 7.11.28 (occasionally), 7.11.29a (rarely), 7.11.29b (commonly); 7.12.1a (rarely), 7.12.1c (rarely), 7.12.16a (occasionally), 7.12.19a (rarely) and 7.12.67 (rarely).

**Phenology:** Flowers have been recorded from October to December; fruits have been recorded from June and July.

**Notes:** The flowers of *Coelospermum purpureum* have been recorded as “fragrant”, with a “pleasant scent” and with a perfume which “resembles Gardenia and Frangipanni” at anthesis.

A few collections (*Gray 5645* (CNS), *Hyland 13327* (CNS) and *Ford 2290* (CNS)) have seemingly sessile flowers, with the distinctive long and slender pedicel being absent. In these collections the flowers are fused to each others’ bases/hypanthia. This feature occurs in several *Coelospermum* species and is commonly found in *Morindeae sens. str.*, as well as distantly related Rubiaceae tribes (Robbrecht 1988; Razafimandimbison & Bremer 2002; Razafimandimbison *et al.* 2008).

Johansson (1988) acknowledges the genus *Coelospermum* as having a “tendency towards heterostyly”. This condition has been observed in *Coelospermum purpureum* with measurements of androecium and gynoecium for ‘long styled flowers’ and ‘short styled flowers’ being provided above. Field observations indicate that each form is specific to an individual plant and both forms grow in the same area and produce fruit. At this time it is unknown whether *Coelospermum purpureum* is an obligate outbreeder.

**Affinities:** *Coelospermum purpureum* is morphologically similar to *C. crassifolium* J.T.Johanss. (from New Caledonia) in that the latter often forms a shrub, has few-flowered inflorescences with mostly pedicellate flowers and has mostly simple drupaceous fruits. *Coelospermum purpureum* differs in having thinner leaves that are dark green on the adaxial surface (compared with thick leaves that are green or yellowish-green in *C. crassifolium*), leaf margins flat (reflexed in *C. crassifolium*) and longer corolla tubes (8–13 mm long compared with 3–7 mm long in *C. crassifolium*). Unlike the other species of *Coelospermum* in Australia (*C. dasylobum* Halford & A.J.Ford and *C. paniculatum* F.Muell.), *C. purpureum* is usually a bushy shrub to small tree. A comparison of diagnostic differences between *C. dasylobum*, *C. paniculatum* and *C. purpureum* is provided in **Table 1**.

**Table 1. Morphological comparison between *C. dasylobum*, *C. paniculatum* and *C. purpureum*.**

| Character                               | <i>C. dasylobum</i>                                                                    | <i>C. paniculatum</i>                                                                  | <i>C. purpureum</i>                              |
|-----------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------|
| habit                                   | twining vine or scandent shrub with long arching stems                                 | liana                                                                                  | bushy shrub to small tree                        |
| corolla tube length                     | 5–7 mm                                                                                 | 3–6 mm                                                                                 | 8–13 mm                                          |
| corolla lobes                           | densely hairy adaxially                                                                | glabrous                                                                               | glabrous                                         |
| corolla lobes length                    | 5–7.5 mm                                                                               | 6–7 mm                                                                                 | 9.5–13 mm                                        |
| young stems and inflorescences branches | glabrous                                                                               | hispidulous                                                                            | glabrous                                         |
| fruit colour                            | yellow-orange to yellow-brown                                                          | red to purple                                                                          | yellow-orange                                    |
| fruit form                              | compound syncarpous drupe                                                              | simple drupe or compound syncarpous drupe                                              | simple drupe rarely compound syncarpous drupe    |
| inflorescence                           | many-flowered paniculate umbel-like dichasial cymes or rarely axillary dichasial cymes | many-flowered paniculate umbel-like dichasial cymes or rarely axillary dichasial cymes | 2 to 4-flowered umbel-like, pedunculate dichasia |
| tertiary venation on lower leaf surface | raised                                                                                 | not raised                                                                             | not raised                                       |
| domatia                                 | present                                                                                | present                                                                                | absent                                           |

**Key to the species of *Coelospermum* in Australia**

- 1 Shrub or small tree, erect, flowers usually simple and on long and slender pedicels . . . . . **C. purpureum**
- 1. Woody vine, twining or scandent, flowers usually arranged into dense, many flowered clusters . . . . . **2**
- 2 Young stems glabrous; corolla lobes densely hairy on adaxial surface . . . . . **C. dasylobum**
- 2. Young stems with fine short hairs; corolla lobes glabrous on adaxial surface. . . . . **C. paniculatum**

**Conservation status:** Most existing collections of *Coelospermum purpureum* have been made within the World Heritage Area of the Wet Tropics. *Coelospermum purpureum* has been collected in Cedar Bay, Daintree and Wooroonooran National Parks. It has a wide, but restricted and disjunct geographical range,

with an extent of occurrence estimated to be 680 km<sup>2</sup> and an area of occupation estimated to be 550 km<sup>2</sup>; however, it is not considered at risk at this time. This is despite *C. purpureum* fulfilling some of the Geographical Range criteria of IUCN (2001), viz. VUB1 or VUB2, however there is no evidence to support a

projected or inferred decline in population numbers as the vast majority of the Extent of Occurrence is within the Wet Tropics World Heritage Area. In addition, *C. purpureum* is a dominant and common shrub where it occurs, with the exceptions being at the extremes of its altitudinal range.

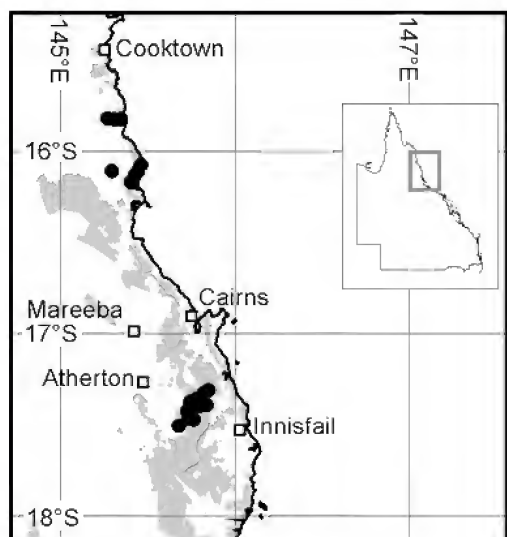
**Etymology:** The specific epithet, from Latin *purpureus*, purple, refers to the colour of the leafy twigs, stipules and petioles of this species, when fresh.

### Acknowledgements

The authors wish to thank Will Smith for the illustration; Peter Bostock for providing the distribution map; Les Pedley for the translation of the diagnosis into Latin; Aaron Davis for bringing this species to our attention; Sylvain Razafimandimbison for comments on the species relationships. Wendy Cooper and Helen Murphy gave generously of their time providing field assistance. Permits to collect in the “Wet Tropics” were issued by the Environmental Protection Agency. The curators and staff at BRI and CNS (formerly QRS) are thanked for allowing access to specimens and the use of their facilities.

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**Map 1.** Distribution of *Coelospermum purpureum* • in north-east Queensland. Shaded area on map indicates nature conservation reserves (National Parks, Forest Reserves and Conservation Parks).

# *Homoranthus tricolor* (Myrtaceae), a new species from south-eastern Queensland

A.R. Bean

## Summary

Bean, A.R. (2009). *Homoranthus tricolor* (Myrtaceae), a new species from south-eastern Queensland. *Austrobaileya* 8(1): 77–79. A new species of *Homoranthus* is described, illustrated and diagnosed against related species. It is of very restricted distribution near Mundubbera in south-eastern Queensland.

Key Words: *Homoranthus tricolor*, Myrtaceae, taxonomy, Queensland flora

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## Introduction

In September 2007, Trevor Ritchie (DERM, Maryborough) discovered an unusual *Homoranthus*. Photographs and specimens were sent to the Queensland Herbarium. The material could not be matched with any existing specimens, nor would it key to any species in Craven and Jones (1991). It did not match either of the two species described by Hunter (1998), and while very similar to *H. coracinus* in floral characters (Bean 2000), it could be easily distinguished from that species on leaf morphology. This new species is described as new, under the name *H. tricolor*.

**Homoranthus tricolor** A.R.Bean **species nova**  
ab omnibus aliis speciebus *Homoranthi* floribus  
pendulis saepe solitariis, bracteolis grandibus  
praecipue viridibus persistentibus, hypanthio  
rubro cylindrico, sepalis nigris laciniatis et  
petalis praecipue nigris sed ad extremum  
distale viridibus distincta. **Typus:** Queensland.  
BURNETT DISTRICT: near junction of Delubra and  
Cadarga Creeks, 35 km SW of Mundubbera, 19  
September 2008, A.R.Bean 27986 & T.Ritchie  
(holo: BRI (1 sheet + spirit); iso: AD, CANB,  
MEL, NSW, US, *distribuendi*).

Erect spreading shrub to 1.4 m high and 1 m wide. Bark grey, fibrous, slightly furrowed towards base of older plants. Leaves linear to narrowly oblanceolate, 5.3–7.2 mm long, 0.6–

0.9 mm wide, green to grey-green, oil glands scattered and readily visible, apex acute to mucronulate; margins entire, not recurved in fresh material, but strongly recurved in dried material. Petioles 0.5–0.7 mm long. Inflorescence borne in upper leaf axils, 1 or 2 flowered. Bracteoles cymbiform, not keeled, 6–7 mm long, 5.3–5.8 mm wide, gland-dotted, mainly green but with white or red margins, apex obtuse, persistent at least until anthesis, enclosing base of hypanthium. Pedicels absent; peduncles 2.2–3.5 mm long. Flowers pendulous; hypanthium glabrous, 5-angled basally, otherwise cylindrical, 6–6.5 mm long, 5–5.5 mm wide, papillose to ruminant and pale green basally, smooth and red distally. Sepals 5, each 5–6 mm long, 1.2–1.5 mm wide, black, entire and slightly tapering in basal half, and with 3–5 black lacinate lobes distally. Petals elliptical, concavo-convex, adnate to the distal part of the hypanthium, 4.7–5.2 × 2.8–3.2 mm, dark purple to black basally and medially, apex and margins pale green, apex obtuse, margins entire. Stamens 10, alternating with staminodes; filaments 0.5–0.8 mm long, anthers globose, basifixed, dehiscent by pores. Style 18–20 mm long, straight or distally curved, creamy white, glabrous except for some simple spreading eglandular hairs below the stigmatic area. Ovules 10–12, collateral in two longitudinal rows. Fruits not seen. **Fig. 1.**

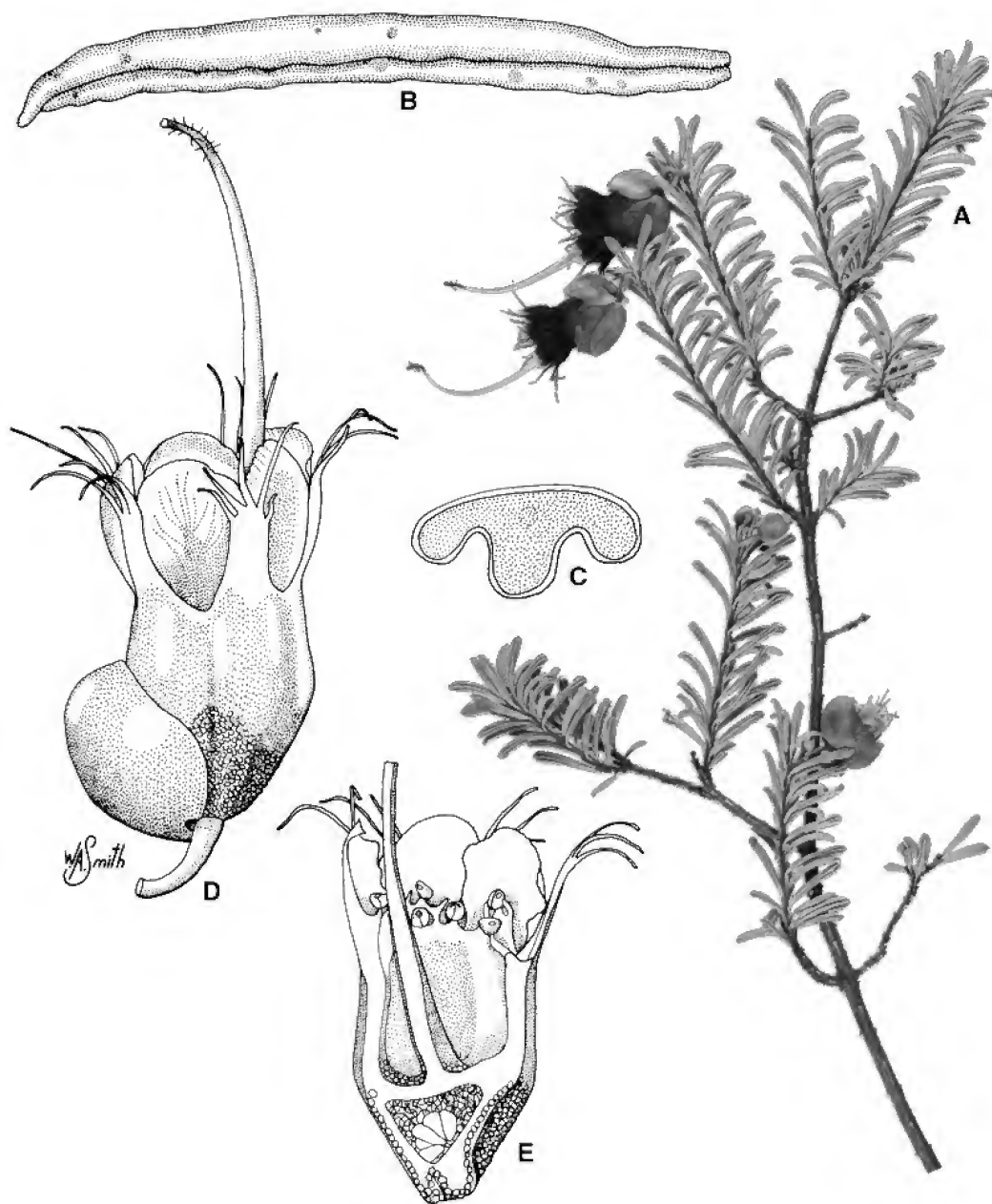


**Fig. 1. *Homoranthus tricolor*.** A. flowering branchlet  $\times 1.4$ . B. lateral view of leaf  $\times 12$ . C. cross-section of leaf  $\times 24$ . D. flower with one bracteole removed  $\times 4$ . E. longitudinal section of flower  $\times 4$ . All from *Bean 27986 & Ritchie* (BRI). Del. W. Smith.

**Additional specimen examined: Queensland.** BURNETT DISTRICT: Cadarga Creek, 36 km SW of Mundubbera, Sep 2007, *Ritchie s.n.* (BRI [AQ 742134]).

**Distribution and habitat:** *Homoranthus tricolor* is known from a single population

near Cadarga Creek in the Mundubbera area of south-eastern Queensland. It inhabits a quartzose sandstone ridge, as a component of shrubby eucalypt woodland. Associated species include *Corymbia watsoniana* (F.Muell.)

K.D.Hill & L.A.S.Johnson subsp. *watsoniana*, *C. trachyphloia* (F.Muell.) K.D.Hill & L.A.S.Johnson, *Grevillea whiteana* McGill., *Acacia calantha* Pedley and *Callitris endlicheri* (Parl.) F.M.Bailey.

**Phenology:** Flowers are recorded for September only, but the flowering period would certainly extend to October.

**Notes:** The nearest relative of *Homoranthus tricolor* is not clear. It seems closest to the species which have conspicuous, persistent bracteoles and laciniate sepals, in particular *H. coracinus*, *H. darwinioides*, *H. decasetus* and *H. porteri*. These species are closely allied to each other in the phenetic analysis of Copeland *et al.* (2007).

*Homoranthus tricolor* is readily distinguished from these and all other *Homoranthus* species by its pendulous, often solitary flowers, large mainly-green bracteoles, red cylindrical hypanthium, black laciniate sepals, and petals mainly black but green at the distal end. *H. tricolor* has great potential for horticulture as the flowers are well displayed, relatively large, and exhibit a variety of colours. Pollinators are not known, but native bees and other insects were observed visiting the flowers.

**Conservation status:** The total known population is estimated to be approximately two hundred plants and is on a Grazing Homestead Perpetual Lease used for grazing cattle. Fire response is unknown. Some plants in the population have trunks around 50 mm diameter, and hence must be decades old. However, a variety of age classes are present. There is no evidence of a decline in numbers of mature individuals.

The recommended conservation status using the Red List criteria (IUCN 2001) is Endangered (criterion D).

**Etymology:** The Latin epithet *tricolor* (meaning three-coloured) alludes to the three distinct colours on the flowers, *i.e.* green, red and black.

## Acknowledgements

I thank Will Smith for the illustration, Peter Bostock for the Latin diagnosis, and Trevor Ritchie for facilitating my visit to the type locality.

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# Two new species of *Morinda* L. (Rubiaceae) from north-east Queensland

D.A.Halford<sup>1</sup> & A.J.Ford<sup>2</sup>

## Summary

Halford, D.A. & Ford, A.J. (2009). Two new species of *Morinda* L. (Rubiaceae) from north-east Queensland. *Austrobaileya* **8**(1): 81–90. *Morinda constipata* Halford & A.J.Ford and *Morinda retropila* Halford & A.J.Ford are described, illustrated and diagnosed against allied species. Notes on habitat, distribution, and conservation status are provided.

Key Words: *Morinda constipata*, *Morinda retropila*, Rubiaceae, Australian flora, Queensland flora, taxonomy, new species

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## Introduction

The genus *Morinda* L. comprises between 30 (Razafimandimbison *et al.* 2009) and 80 (Mabberley 1997) species mostly in the Old World tropics. Eight described species have been recognised for Australia (Halford & Ford 2004). In this paper we describe a further two new species of *Morinda* endemic to north-eastern Queensland.

The species here described as *Morinda retropila* Halford & A.J.Ford has been known in the past by the misapplied name *Morinda hypotephra* F.Muell. (= *Palmeria hypotephra* (F.Muell.) Domin) (Reynolds & Halford 1994, 1997). In 1999, the first author examined flowering and fruiting material of this species and considered it differed from *Morinda* in having pedicellate flowers arranged in fascicles at the branchlet nodes and simple drupaceous fruits. *Morinda* is traditionally circumscribed as having sessile flowers forming congested capitula and compound syncarpous drupaceous fruits (Bentham 1866; Backer & Bakhuizen van den Brink 1965; Verdcourt 1976; Smith 1988). Uncertainties regarding the circumscription of the genus *Morinda* and the authors' lack of knowledge of the morphological variation over the wider geographical range of the genus prevented the formal naming of the species. It has been most recently listed (at BRI) under the phrase

name Gen.(Aq124851) sp. (Boonjie L.J.Webb+ 6837A) (Forster & Halford 2007).

The other species here described as *Morinda constipata* was first known from a single flowering specimen collected in 1974 and was originally identified as *M. umbellata* L. Examination of targeted and recent more ample collections of flowering and fruiting material reveal that it is a new and undescribed species similar to Gen.(Aq124851) sp. (Boonjie L.J.Webb+ 6837A) in having flowers arranged in fascicles at the branchlet nodes. It has been listed (at BRI) under the phrase name *Morinda* sp. (Bellenden Ker W.Cooper+ 1526) (Forster & Halford 2007).

A recent molecular (*rps16* intron, *trnT-F* and *nrITS*) study (Razafimandimbison *et al.* 2009) of the Rubiaceae tribe *Morindeae* Miq. *s.s.* has inferred that *Morinda* as presently delimited is paraphyletic. The two new species here described form a small subclade with another two Australian endemic *Morinda* (*M. canthoides* (F.Muell.) Halford & R.J.F.Hend. and *M. jasmynoides* A.Cunn. ex Hook.) that is nested within a larger *Gynochthodes*–*Morinda* clade. Razafimandimbison *et al.* (2009) propose to recircumscribe the genus *Morinda* in a narrower sense and broaden the circumscription of *Gynochthodes* to include almost all lianescent *Morinda* species. Until this is formally published and for conformity we name the new species in *Morinda*.

## Materials and methods

The study is based upon the examination of herbarium material from BRI and CNS (formerly QRS) with field observations by the second author. All specimens cited have been seen by one or both authors. Measurements of the floral parts and fruits are based on material preserved in 70% ethanol. Common abbreviations in the specimen citations are: L.A. (Logging Area), N.P.R. (National Park/Reserve), S.F.R. (State Forest Reserve) and T.R. (Timber Reserve). The abbreviation RE in the distribution and habitat notes refers to Regional Ecosystem, descriptions of which can be viewed at (in this case); [www.epa.qld.gov.au/projects/redd/landzone.cgi?bioregion=7](http://www.epa.qld.gov.au/projects/redd/landzone.cgi?bioregion=7).

Extent of occurrence estimates were derived from the validation of original collection localities. These data points were loaded into ESRI ArcView 3.2 and the draw polygon feature was used to calculate the area between the points. The area of occupation estimates were principally derived from a digital Regional Ecosystem map supplemented by the second author's knowledge of vegetation types and habitats within the Wet Tropics bioregion (referred to as the Wet Tropics hereafter) (Environment Australia 2005).

## Taxonomy

**Morinda constipata** Halford & A.J.Ford, **species nova** similis *M. canthoidi* (F.Muell.) Halford & R.J.F.Hend. et *M. retropila* Halford & A.J.Ford. Ab illa foliis chartaceis anguste ellipticis in ambitu apice longe acuminatis instructis (vice foliorum coriaceorum ovatorum usque oblongo-ovatorum in ambitu apice breviter acuminato instructorum) ramulis juvenibus glabris (non hispidulis) differt. A *M. retropila* caespodomatiis praeditis (vice domatorum carentium), caulibus glabris (vice pilorum retrorsorum in caulibus), pedicellis ovariisque glabris (vice pedicellorum ovariorumque pubescentium), plerumque drupis compositis syncarpis parata (vice semper drupae simplici) differt. Collectiones antea pro *M. umbellata* L. determinatae sunt autem ab illa capitulis 2- vel 3-floris in fasciculis axillaribus terminalibusve in pedunculis glabris 1–3 mm

longis portatis (vice capitulorum 5–6-florum in fasciculis terminalibus in pedunculis hispidulis 3–20 mm longis portatorum) differt. **Typus:** Queensland. COOK DISTRICT: National Park Reserve 904, Wooroonooran, just S of tower 9, Mt Bellenden Ker cableway, 17 October 2003, A. Ford AF4184 & J. Holmes (holo: BRI; iso: CNS; L, K, MEL, MO, NSW, SUNIV distribuendi).

*Morinda* sp. (Bellenden Ker) (Cooper & Cooper 2004: 446).

*Morinda* sp. (Bellenden Ker W.Cooper+ 1526) (Forster & Halford 2007: 177).

*Morinda* sp. 2 (Razafimandimbison *et al.* 2009: 881).

Wiry twining vine to 7 m high, androdioecious. Stems to 7 mm diameter. New growth pale green. Branchlets terete, glabrous. Leaves petiolate, opposite; stipules interpetiolar, sheathing, 2–3 mm long, produced into a narrow triangular lobe, glabrous, fragmenting as node thickens; petioles 3–7 mm long; blades discolorous, ± chartaceous and thin, narrow-elliptic, 6–9.5 cm long, 1.5–3.5 cm wide, glabrous; adaxial surface shiny, dark green; abaxial surface paler than adaxial surface; venation brochidodromous with 5–7 lateral veins per side of midvein, slightly raised on adaxial surface, prominent on abaxial surface; midvein conspicuously raised on adaxial surface, prominent on abaxial surface; interlateral venation raised on both surfaces; apex acuminate; base obtuse to acute; margins entire; tuft-domatia present in lateral vein axils on abaxial surface. Flowers usually 3 or 4-merous, bisexual or unisexual (male only), sessile, in 2 or 3-flowered capitula, the flowers joined by the base of the gynoecium or rarely pedicellate. Capitula pedunculate, in axillary or terminal clusters; peduncles 1–3 mm long, glabrous; bracts in connate pairs, cup-shaped, produced into a short triangular lobe, glabrous. Calyx tube truncate or irregularly dentate, 0.4–0.6 mm long, 1.6–1.7 mm across, green, glabrous. Corolla valvate, clavate in bud, deciduous, purplish in colour at base especially in bud and extending towards throat, otherwise white, glabrous on abaxial surface; tube 1.8–3 mm long, slightly widened at the apex, glabrous inside proximally,

densely hairy distally with simple hairs 0.7–0.8 mm long; lobes elliptic, spreading, recurved, 2.2–3.5 mm long, 1.7–2.4 mm wide, glabrous adaxially, acute at apex. Bisexual flowers: stamens exserted; filaments 0.5–0.6 mm long, adnate to corolla tube c. 0.8 mm below the sinuses of the corolla lobes; anthers dorsifixed, oblong, 1.1–1.4 mm long, dehiscing laterally; disc annular, entire, convex, c. 0.4 mm high, glabrous; ovary 2-celled, biovulate, with false septum in the upper part appearing to divide each cell into 2; style 2.5–2.7 mm long (excluding stigma), glabrous; stigma bifid, with spreading lobes 2.7–2.8 mm long, adaxial surface and margin papillate, abaxial surface glabrous. Male flowers: stamens exserted; filaments 0.8–1.2 mm long, inserted c. 0.9 mm below the sinuses of the corolla lobes; anthers dorsifixed, oblong, 1.9–2.1 mm long, dehiscing laterally; disc annular, entire, conical, c. 0.5 mm high, glabrous; ovary undeveloped and lacking functional ovules and style. Fruit a compound syncarpous drupe (rarely simple), subglobose, laterally compressed or shallowly 3-lobed (globose when simple), 6–7 mm long, 10–14 mm across (widest point) (simple drupes are c. 4.5 mm diameter), orange when ripe, persistent calyx tubes not prominent on surface, glabrous; pericarp thin and leathery; mesocarp fleshy, containing 8 to 12 (rarely 4) pyrenes. Pyrenes  $\pm$  obovoid, dorsiventrally compressed, 3.8–4 mm long, 3–3.3 mm wide, 1.9–2.1 mm thick, 1-seeded; endocarp cartilaginous, pale brown,  $\pm$  smooth, with basal marginal groove. Seeds obovate in outline, c.  $3 \times 2.8 \times 1.5$  mm; testa membranous, dark brown; endosperm corneous,  $\pm$  white; embryo c. 1.6 mm long,  $\pm$  straight; cotyledons thin, c. 0.5 mm long and 0.4 mm wide; radicle c.  $1.1 \times 0.5$  mm. Seedlings unknown. **Fig. 1.**

**Additional selected specimens examined: Queensland.** COOK DISTRICT. 50 [m] N of station at top of Bellenden Ker, May 2001, *Cooper & Cooper WWC1526* (BRI, CNS); N.P.R. 904, Wooroonooran, just S of tower 9, Mt Bellenden Ker Cableway, Oct 2003, *Ford AF4182 & Holmes* (BRI, CNS); *ditto loc.*, May 2003, *Ford AF3963 & Green* (BRI, CNS); Bellenden Ker Range, Oct 1974, *Hyland 7765* (BRI, CNS); S.F.R. 310 Bellenden Ker, Sep 1977, *Gray 695* (CNS); S.F.R. 310, Upper Goldsborough L.A., Sep 1976, *Dockrill 1285* (CNS); N.P.R. 904, Wooroonooran, steep slope off 'Donkey Track' off Russell River Track, Oct 2001, *Ford et al. AF2969* (BRI, CNS, NSW).

**Distribution and habitat:** *Morinda constipata* is endemic to the Wet Tropics in north-eastern Queensland, where it is known from three localities c. 18 km apart predominantly on the Bellenden Ker Range (Mt Bellenden Ker and Mt Bartle Frere), with an isolated occurrence in the headwaters of the Russell River (**Map 1**). On the Bellenden Ker Range it is recorded as growing in simple microphyll-notophyll vine fern thickets on a granitic substrate, whereas near the Russell River it occurs in complex notophyll rainforest on soil derived from mudstones. On the Bellenden Ker Range the stunted canopy is dominated by: *Acmena hemilampra* subsp. *orophila* B.Hyland, *Balanops australiana* F.Muell., *Cinnamomum propinquum* F.M.Bailey, *Elaeocarpus ferruginiflorus* C.T.White, *Leptospermum wooroonooran* F.M.Bailey and *Musgravea stenostachya* F.Muell. Common smaller trees and shrubs include: *Alyxia orophila* Domin, *Cyathea rebecca* (F.Muell.) Domin, *Hypsophila halleyana* F.Muell., *Laccospadix australasica* H.Wendl. & Drude, *Linospadix* spp., *Polyosma rigidiuscula* F.Muell. & F.M.Bailey ex F.M.Bailey, *Triunia montana* (C.T.White) Foreman and *Trochocarpa bellendenkerensis* Domin. Although the altitudinal range is 590–1560 m, the majority of collections and reliable recordings are from 1460–1560 m. The species association for the 590 m collection (*Ford et al. AF2969*) is completely different to the Bellenden Ker Range as the substrate is mudstone, and for these details see Halford & Ford (2009, this issue under *Coelospermum purpureum*).

*Morinda constipata* has been collected or reliably reported in the following REs: 7.12.19a (rarely), 7.12.20 (commonly) and 7.11.12a (rarely).

**Phenology:** Flowers have been recorded from September to November, whilst fruits have been recorded from May to July.

**Affinities:** *Morinda constipata* is morphologically similar to *M. canthoides* and *M. retropila*. *Morinda constipata* differs from the former in having chartaceous leaves that are narrow-elliptic in outline, with a long acuminate apex (versus coriaceous leaves that are ovate to oblong-ovate in outline, with a shortly acuminate apex for *M. canthoides*),

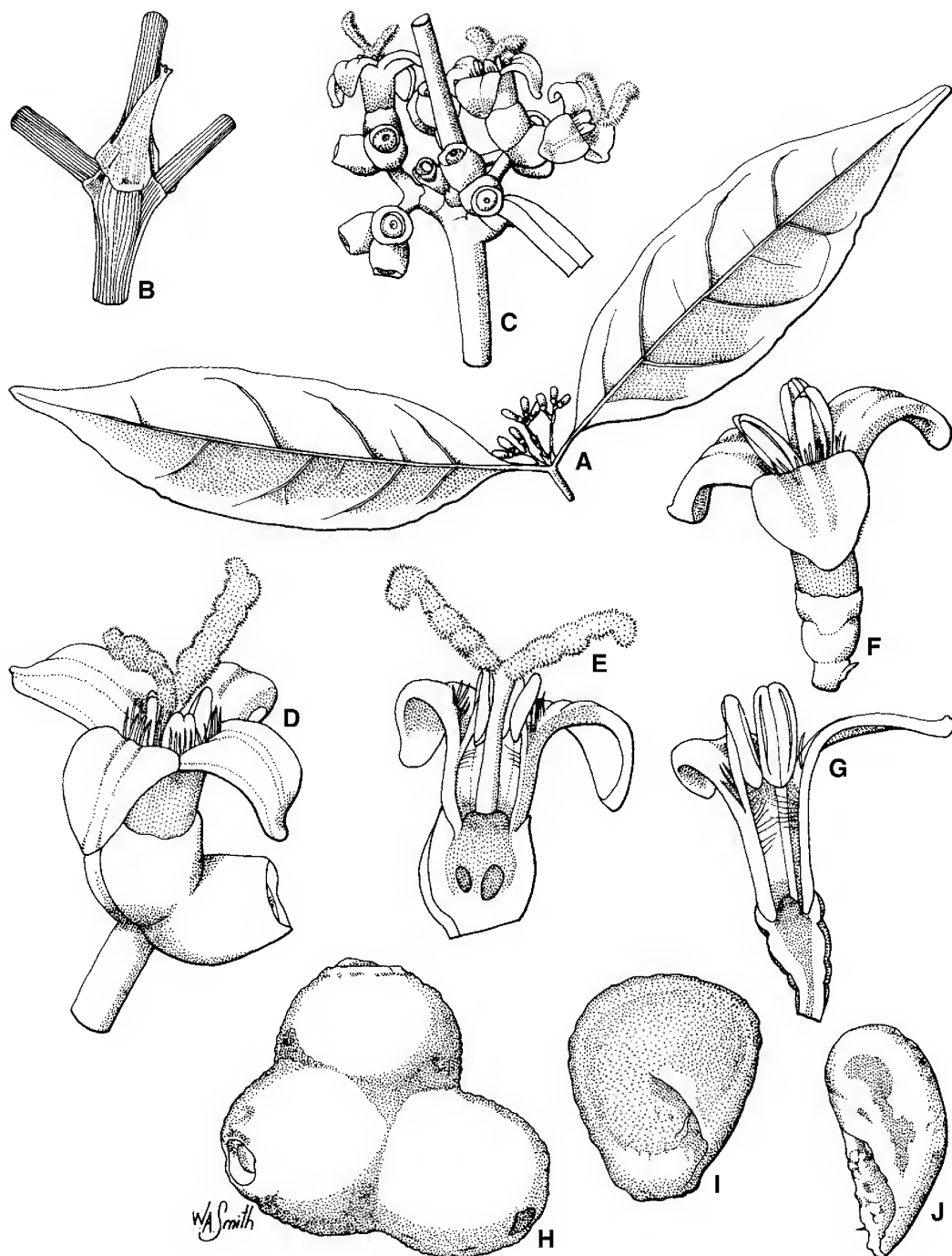


**Fig. 1.** *Morinda constipata*. A. branchlet with inflorescence  $\times 1$ . B. node with stipule  $\times 6$ . C. inflorescence  $\times 3$ . D. bisexual flower at anthesis  $\times 8$ . E. section of bisexual flower at anthesis  $\times 8$ . F. male flower at anthesis  $\times 8$ . G. section of male flower at anthesis  $\times 8$ . H. oblique view of fruit  $\times 4$ . I. adaxial view of pyrene  $\times 8$ . J. lateral view of pyrene  $\times 8$ . A, B, F, G from Ford AF4184 & Holmes (BRI); C–E from Ford AF4182 & Holmes (BRI); H–J from Cooper & Cooper WWC1526 (BRI). Del. W.Smith.

and young branchlets glabrous (versus mostly hispidulous for *M. canthoides*). *Morinda constipata* differs from *M. retropila* in having tuft-domatia (versus domatia absent for *M. retropila*), glabrous stems, (versus retrorse hairs on the stem for *M. retropila*), glabrous pedicels and ovary (versus hairy pedicels and ovary for *M. retropila*), and usually a compound syncarpous drupe (versus always a simple drupe for *M. retropila*). Collections of *M. constipata* have in the past been misidentified as *M. umbellata* but it differs from that in having 2 or 3-flowered capitula in axillary or terminal clusters on glabrous peduncles 1–3 mm long (versus 5 or 6-flowered capitula in terminal clusters on hispidulous peduncles 3–20 mm long for *M. umbellata*).

Razafimandimbison *et al.* (2009) have inferred a close phylogenetic relationship between *Morinda constipata* and *M. jasminoides*. *Morinda constipata* is easily distinguished from that species in having tuft-domatia (versus crypt-type domatia for *M. jasminoides*), interlateral venation distinctly raised on both leaf surfaces (versus interlateral venation obscure or only slightly raised for *M. jasminoides*), flowers sessile in 2 or 3-flowered capitula or flowers pedicellate (versus flowers always sessile in 5 to 10-flowered capitula for *M. jasminoides*), and corolla tube 1.8–3 mm long (versus corolla tube 4–6 mm long for *M. jasminoides*).

**Notes:** *Morinda constipata* occupies a similar niche to *M. podistra* Halford & A.J.Ford, although these species have non-overlapping distributions. Both species flower and fruit in the understorey and the twining stems rarely, if ever, reach the low canopy. In addition, *M. constipata* like *M. podistra* produces locally dense masses of wiry twining stems.

**Conservation status:** *Morinda constipata* is known only from three locations and has an extent of occurrence of only 72 km<sup>2</sup>, which would fit such criteria to be classified as (at least) Vulnerable (ICUN 2001). However, there is no evidence to support a decline in population sizes or extent, and no suggestion of human activities adversely affecting current populations. All existing collections of *M. constipata* have been made

in Wooroonooran National Park within the World Heritage Area of the Wet Tropics. *Morinda constipata* is not considered at risk or under threat at this time.

**Etymology:** The specific epithet is from Latin *constipatus*, crowded closely together, and refers to the flowers arranged in axillary and terminal clusters in this species.

***Morinda retropila*** Halford & A.J.Ford, **species nova** similis *M. canthoidi* (F.Muell.) Halford & R.J.F.Hend. et *M. constipata* Halford & A.J.Ford. Ab ambobus pagina abaxiali folii pallenti et aliquantum crenea differt; paginas abaxiales virides et *M. canthoides* et *M. constipata* habent. *M. retropila* foliis chartaceis anguste ellipticis vel anguste ovatis (vice foliorum coriaceorum ovatorum usque oblongo-ovatorum), venatione interlateralis obscura utrinque folii (vice venationis elevatae), domatiis in axillis venarum lateralium carentibus (vice domatorum praesentium), ramulis juvenibus pilis retrorsis praeditis (vice pilorum patentium) a *M. canthoidi* differt. De proprietatibus quae distinguunt *M. retropilum* a *M. constipata* vide diagnosem *M. constipatae*. **Typus:** Queensland. COOK DISTRICT: Wooroonooran National Park, start of Bartle Frere walking track, 27 November 2001, P.I.Forster PIF27757 & A.M.Young (holo: BRI; iso: CNS *distribuendi*).

*Morinda* sp. (Boonjee) (Cooper & Cooper 1994: 194).

Rubiaceae gen. nov. sp. (Boonjee) (Cooper & Cooper 2004: 452).

Gen.(Aq124851) sp. (Boonjee L.J.Webb+ 6837A) (Forster & Halford 2007: 176).

*Morinda* sp. 1 (Razafimandimbison *et al.* 2009: 881).

*Morinda hypotephra* auct., non F.Muell. (Reynolds & Halford 1994: 297; Reynolds & Halford 1997: 182).

**Illustrations:** Cooper & Cooper (1994: 195), as *Morinda* sp. (Boonjee); Cooper & Cooper (2004: 452) as Rubiaceae gen. nov. sp. (Boonjee).

Slender twining, wiry vine, probably androdioecous. Stems pale, to 5 mm diameter. New growth pale green, slightly resinous. Young branchlets terete, moderately to densely hairy becoming glabrous with age; hairs simple, retrorse, 0.05–0.2 mm long; older branchlets rugose, glabrous, light grey. Colleters abundant at nodes of young branchlets inside at base of stipules; raphides abundant. Leaves petiolate, opposite; stipules interpetiolar, sheathing, 1.7–3 mm long, chartaceous, truncate, moderately hairy on abaxial surface with hairs as for branchlets, glabrous on adaxial surface, fragmenting as nodes thicken; petioles green when fresh,  $\pm$  terete, 4–10 mm long, moderately to densely hairy with spreading hairs up to 0.2 mm long; blades discolorous, chartaceous and thin, narrow-elliptic or narrow-ovate, 5.5–10 cm long, 2–4 cm wide, length/width ratio 2.5–4:1, adaxial surface glabrous, shiny, dark green; abaxial surface very pale and somewhat creamish in colour, sparsely hairy with spreading hairs up to 0.2 mm long; venation brochidodromous with 4–8 lateral veins per side of midvein; midvein conspicuously raised on adaxial surface, prominent on abaxial surface; lateral venation  $\pm$  obscure on adaxial surface, raised on abaxial surface; interlateral venation  $\pm$  obscure on both surfaces; apex usually acuminate with acumen up to 1.5 cm long or rarely acute; base obtuse to rounded or abruptly cuneate; margins entire; domatia absent. Inflorescences 2 or 3-flowered umbel-like cymes; cymes shortly pedunculate, axillary, 1 to many per node; peduncles 0.5–0.8 mm long; bracts in connate pairs, cup-shaped, truncate, up to 1 mm long, whitish, sparsely hairy abaxially with spreading hairs up to 0.1 mm long. Flowers pedicellate (simple and not sessile in capitula), 3–5 (mostly 4)-merous, bisexual or possibly unisexual on separate plants; pedicels terete, 1–4 mm long, hispidulous with hairs  $<$  0.1 mm long. Calyx tube 0.5–0.8 mm long, 1.5–1.7 mm wide, hispidulous on abaxial surface. Corolla valvate, clavate in bud with 3 or 4 short protuberances apically, deciduous; tube 2.9–3 mm long widening distally, minutely hairy abaxially, densely hairy in throat with long ascending hairs, 0.4–1.3 mm long; lobes triangular, 2–2.6 mm long, 1.5–2.2 mm wide

recurved; adaxial surface minutely papillose, with median longitudinal ridge; abaxial surface smooth and glabrous; apex inflexed. Disc annular, convex, *c.* 0.4 mm long, glabrous. Ovary bilocular; ovules 2 in each locule, with false septum in the upper part appearing to divide each into 2, funicle inserted at base of dissepiment. Bisexual flowers: stamens inserted in throat of corolla tube; staminal filaments 0.5–0.8 mm long, adnate to corolla tube 2–2.5 mm below the sinuses of the corolla lobes; anthers 1.6–1.9 mm long; styles 3.6–4.6 mm long (including stigma), exserted from corolla tube; stigma bifid, 0.5–1.4 mm long,  $\pm$  erect, upper surface papillose, lower surface smooth. Unisexual flowers: stamens inserted in corolla tube; staminal filaments 0.8–1 mm long, adnate to corolla tube 1.5–1.8 mm below the sinuses of the corolla lobes; anthers 1.5–2.2 mm long; style absent, stigma bifid, 0.3–0.6 mm long, erect, subulate, glabrous. Fruit a simple drupe, subglobose, 5–10 mm long, 4.5–9 mm across, umbilicate, orange when ripe, glabrous; pericarp thin; mesocarp fleshy, containing up to 4 pyrenes. Pyrenes  $\pm$  ellipsoid in outline, 3-sided, 2.4–3 mm long, 2.2–2.6 mm wide, 1.4–1.6 mm thick, 1-seeded; endocarp cartilaginous, pale brown,  $\pm$  smooth, with basal marginal groove. Seeds elliptic in outline, 2.3–2.5 mm long, 1.8–1.9 mm wide, 0.8–1 mm thick; testa membranous, pale brown; endosperm corneous,  $\pm$  white; embryo *c.* 1.4 mm long,  $\pm$  straight; cotyledons thin, *c.* 0.5 mm long and 0.5 mm wide; radicle *c.* 0.9  $\times$  0.4 mm. Germination epigeal (phanerocotylar); cotyledons ovate-reniform, 7–9 mm long, 6–9 mm wide, apex obtuse or bluntly pointed, base attenuate-auriculate. **Fig. 2.**

**Additional selected specimens examined: Queensland.** COOK DISTRICT: N.P.R. 133, Mt Sorrow Ridge walking track, Nov 2000, *Ford AF2527 et al.* (BRI); Mt Edith Road, off Danbulla Forest Drive, Apr 2004, *Bradford 3* (BRI, CNS); T.R. 1230, Boonjee L.A., SE of Butchers Creek township, Nov 1988, *Jessup G.JM5204 et al.* (BRI); N.P.R. 904, Wooroonooran, *c.* 300 m along track to Mt Bartle Frere, Apr 2004, *Bradford 2* (BRI); Wooroonooran N.P., Bartle Frere track before Bobbin Bobbin Falls, Oct 1997, *Forster PIF21748 et al.* (BRI, CNS); property of W. & W. Cooper, Topaz, Nov 2005, *Halford Q8853 & Jensen* (BRI); vacant crown land, Bartle Frere E of Glen Allyn Trig., Feb 1962, *Webb & Tracey 5794* (BRI); Boonjee, W of Mt Bartle Frere, 1962, *Webb & Tracey 6837A* (BRI); Foot of Bartle Frere, 1 km ESE of Josephine falls, Aug

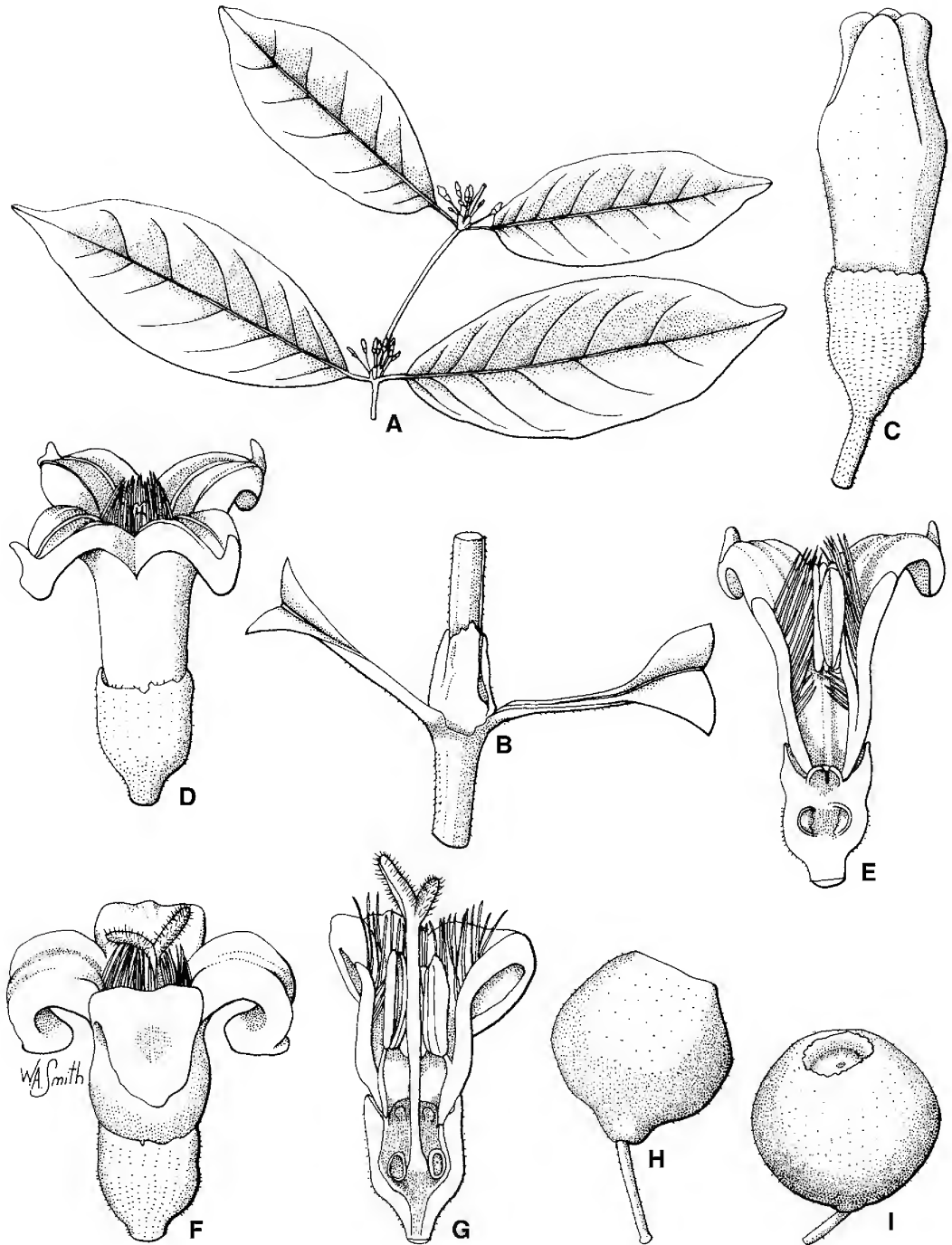


**Fig. 2.** *Morinda retropila*. A. branchlet with inflorescences  $\times 0.4$ . B. node with stipule  $\times 8$ . C. flower bud  $\times 8$ . D. unisexual flower (short styled) at anthesis  $\times 8$ . E. section of unisexual flower (short styled) at anthesis  $\times 8$ . F. bisexual flower (long styled) at anthesis  $\times 8$ . G. section of bisexual flower (long styled) at anthesis  $\times 8$ . H. lateral view of fruit  $\times 4$ . I. oblique view of fruit  $\times 4$ . A from Forster PIF21748 *et al.* (BRI); B, F, G from Forster PIF26530 & Booth (BRI); C–E from Cooper WWC1620 (BRI); H, I from Bradford 2 (BRI). Del. W.Smith.

2000, *Lyons* 203 (BRI, CNS); S.F.R. 755, Gosschalk L.A., E.P./34, Nov 1976, *Fitzsimon* 241 (CNS); Topaz, Towalla road, Nov 2001, *Cooper WWC1620* (BRI, CNS); Towalla, Coolamon Creek, May 2002, *Booth* 3113 & *Jensen* (BRI); N.P.R. 904, Wooroonooran, c. 700 m S of Towalla Mine, along old logging track, Oct 2001, *Ford AF3029 et al.* (BRI); S.F.R. 650, Mt Fisher, c. 400 m SE of peak “1230”, Nov 2002, *Ford AF3683* (CNS); 6 km SSW of Millaa Millaa, end of Whiting road, property D. & S. Clague, Dec 2000, *Forster PIF26530 & Booth* (BRI). NORTH KENNEDY DISTRICT: S.F.R. 251, Koolmoon L.A., 1.5 km S of Coochimbeerum road, May 2001, *Ford AF2861* (BRI); S.F.R. 251, Koolmoon L.A., 1.5 km S of Coochimbeerum road, off Tully Falls road, Koolmoon Creek, Nov 2002, *Ford AF3700 & Holmes* (BRI, CNS); Tableland L.A., 0.5 km S of Koolmoon Creek near junction of Ebony road and Tully Falls road, 6 km NW of Tully Falls, Oct 1988, *Jessup GJM2666 et al.* (BRI).

**Distribution and habitat:** *Morinda retropila* is endemic to the Wet Tropics in north-eastern Queensland. It is currently known to occur from the Danbulla area on the Lamb Range to the Tully Falls area on the southern edge of the Atherton Tableland, with disjunct populations near Cape Tribulation (Mt Sorrow) and on the eastern foothills of Mt Bartle Frere (**Map 2**). It is recorded as growing in the wetter, simple to complex notophyll vine forest or complex mesophyll vine forest on substrates which range from basalt, mudstone, granite and rhyolite to granitic alluvium. Occurrences on rhyolite, granite, granitic alluvium and mudstone are less common, with *M. retropila* being most common on basalt. Common canopy trees on basaltic substrates include: *Beilschmiedia bancroftii* (F.M.Bailey) C.T.White, *Cardwellia sublimis* F.Muell., *Castanospora alphanthii* (F.Muell.) F.Muell., *Cryptocarya oblata* F.M.Bailey, *Doryphora aromatica* (F.M.Bailey) L.S.Sm., *Elaeocarpus largiflorens* C.T.White subsp. *largiflorens*, *Endiandra bessaphila* B.Hyland, *Ficus pleurocarpa* F.Muell., *Franciscodendron laurifolium* (F.Muell.) B.Hyland & Steenis and *Opisthiolepis heterophylla* L.S.Sm. Common small trees and shrubs on basaltic substrates include: *Antirhea tenuiflora* F.Muell. ex Benth., *Apodytes brachystylis* F.Muell., *Atractocarpus hirtus* (F.Muell.) Puttock, *Bubbia semecarpoides* (F.Muell.) B.L.Burt, *Irvingbaileya australis* (C.T.White) R.A.Howard, *Niemeyera prunifera* (F.Muell.) F.Muell., *Pilidiostigma tetramerum* L.S.Sm., *Symplocos hayesii* C.T.White & W.D.Francis and *Wilkia angustifolia* (F.M.Bailey)

J.R.Perkins. Although the altitude range is 120–1200 m, *M. retropila* appears to be more common in the 600–1000 m band.

*Morinda retropila* has been collected or reliably reported in the following REs: 7.3.10a (rarely), 7.3.36a (rarely), 7.8.1a (rarely), 7.8.2a (commonly), 7.8.4a (commonly), 7.11.12a (occasionally), 7.12.1a (rarely), 7.12.16a (occasionally).

**Phenology:** Flowers have been recorded from October to January, whilst fruits have been recorded from February to July.

**Affinities:** *Morinda retropila* is morphologically similar to *M. canthoides* and *M. constipata*. *Morinda retropila* differs from both in having a very pale and somewhat creamish in colour abaxial leaf surface. Both *Morinda canthoides* and *M. constipata* have green abaxial surfaces. *Morinda retropila* differs from the former in having chartaceous leaves that are narrow-elliptic or narrow-ovate (versus coriaceous leaves that are ovate to oblong-ovate for *M. canthoides*), interlateral venation obscure on upper and lower leaf surfaces (versus interlateral venation raised for *M. canthoides*), domatia lacking in axils of lateral veins (versus domatia present for *M. canthoides*) and young branchlets with retrorse hairs (versus spreading hairs for *M. canthoides*). For features distinguishing *M. retropila* from *M. constipata*, refer to the ‘Affinities’ section under that species.

Razafimandimbison *et al.* (2009) have inferred a close phylogenetic relationship between *Morinda retropila* and *M. jasminoides*. *Morinda retropila* is easily distinguished from that species by having pedicellate flowers arranged in fascicles at the branchlet nodes (versus flowers always sessile in 5 to 10-flowered pedunculate capitula arranged in terminal and axillary umbels for *M. jasminoides*), simple drupaceous fruits (versus compound syncarpous drupe for *M. jasminoides*), corolla tube c. 3 mm long (versus corolla tube 4–6 mm long for *M. jasminoides*), domatia lacking in axils of lateral veins of leaves (versus crypt-type domatia for *M. jasminoides*).

**Notes:** The flowers from the collections *Cooper WWC1620*, *Forster PIF27757* and *Forster PIF21748 et al.* are interpreted as being unisexual as they have pollen producing anthers but have a style reduced to two small subulate stigmatic lobes that only just extend beyond the annular disk, although the ovary is well developed with what appear to be functional ovules. The flowers from collections *Ford AF3029 et al.* and *Forster PIF26530 & Booth* appear to be bisexual with a well developed style, stigma, ovary and pollen producing anthers. Further flowering material and field investigations are required to assess what reproductive strategies are present in this species. This is a similar floral arrangement as reported in *Morinda podistra* (Halford & Ford 2004).

Recently expanded leaves have a velvet-like appearance on the adaxial surface, even though the surface is glabrous. It has been described as having a taffeta-like shine (Cooper & Cooper 2004: 452).

**Conservation status:** Most existing collections of *Morinda retropila* have been made within the World Heritage Area of the Wet Tropics. It has been collected in Daintree, Woornooran, Tully Falls, Maalan and Danbulla National Parks. *Morinda retropila* has an extent of occurrence estimated to be no less than 1550 km<sup>2</sup> and occurs over a large, but narrow, geographical area. Accordingly it is not considered at risk or under threat at this time.

**Etymology:** The specific epithet is from Latin *retro*, backward, and *pilus* hair in reference to the retrorse hairs on the branchlets of this species.

### Acknowledgements

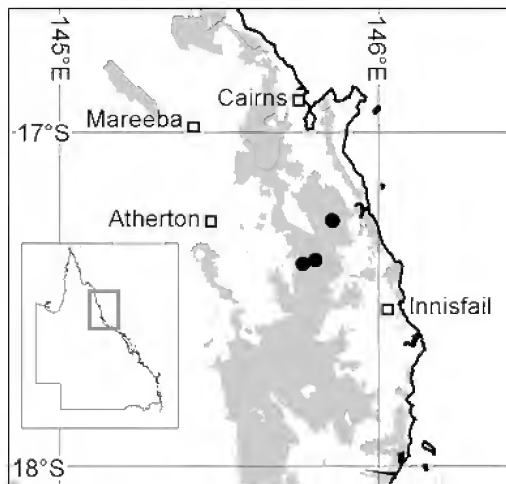
The authors wish to thank Will Smith for the illustrations, Peter Bostock for providing the distribution maps and Les Pedley the translation of the diagnoses into Latin. Wendy Cooper and Matt Bradford collected critical material for interpretation and illustrations. Spiro Buhagiar of Transmission Holding Limited Australia (THL) is warmly thanked for facilitating access to *Morinda constipata* populations on Mt Bellenden Ker. Permits to

collect in the Wet Tropics were issued by the Department of Environment and Resource Management (formerly EPA). The curators and staff at BRI and CNS (formerly QRS) are thanked for allowing access to specimens and the use of their facilities.

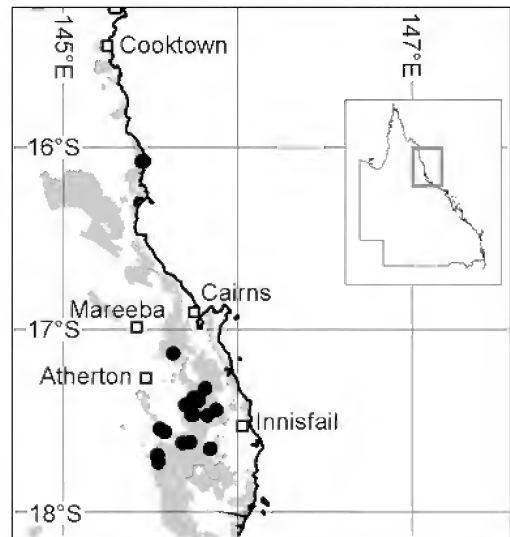
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**Map 1.** Distribution of *Morinda constipata* • in north-east Queensland. Shaded area on map indicates nature conservation reserves (National Parks, Forest Reserves and Conservation Parks).



**Map 2.** Distribution of *Morinda retropila* • in north-east Queensland. Shaded area on map indicates nature conservation reserves (National Parks, Forest Reserves and Conservation Parks).

# ***Mischocarpus ailae* Guymmer (Sapindaceae), a new species from the Mount Warning caldera, Australia**

**G.P. Guymmer**

## **Summary**

Guymmer, G.P. (2009). *Mischocarpus ailae* Guymmer (Sapindaceae), a new species from the Mount Warning caldera, Australia. *Austrobaileya* **8**(1): 91–95. *Mischocarpus ailae* from south-east Queensland and north-east New South Wales is described as new with notes on its distribution, habitat and conservation status. A key to the Australia species of *Mischocarpus* is provided.

**Key Words:** Sapindaceae, *Mischocarpus*, *Mischocarpus ailae*, *Mischocarpus lachnocarpus*, taxonomy, Australian flora, Queensland flora, new species, identification key

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## **Introduction**

The genus *Mischocarpus* Blume (tribe *Cupanieae* Blume, family Sapindaceae) has 20 species and is distributed throughout Asia, from India and China to Melanesia and eastern Australia (Van der Ham 1977; Reynolds 1985a, 1985b). Australia has 11 species (10 endemic) that occur from Cape York, Queensland to the central coast of New South Wales. A critical examination of *Mischocarpus* specimens at the Queensland Herbarium has revealed that the southern populations previously referred to *M. lachnocarpus* (F.Muell.) Radlk. in south-east Queensland and north-east New South Wales represent a quite distinct new species and it is formally described here.

## **Material and methods**

The information presented in this paper is based on examination of herbarium collections at the Queensland Herbarium (BRI) and National Herbarium of New South Wales (NSW) and observations of plants in the field. The descriptions are modelled on those of Reynolds (1985a, 1985b).

## **Taxonomy**

***Mischocarpus ailae* Guymmer, species nova** differt a *Mischocarpus lachnocarpus* capsulis majoribus luteis globularibus (14–18 mm longis), arillo luteo aurantiacove, praesentia petalorum et filamentis pilosis.

**Typus:** New South Wales. NORTH COAST: Mt Warning, 8 March 2009, *D.A. Halford Q9671 & G.P. Guymmer* (holo: BRI; iso: BRI, K, L, MEL, NSW).

*Mischocarpus lachnocarpus* auct. non F.Muell., Floyd (1977, 1989, 2008); Van der Ham (1977, [south east Queensland and New South Wales specimens]); Reynolds (1983 [excluding the illustration], 1985a & 1985b, [Springbrook Plateau & New South Wales specimens, & illustrations]); Harden (1991, [excluding the illustration of the capsule]); Logan River Branch SGAP (2005); Leiper *et al.* (2008).

**Illustrations:** Reynolds (1985a, p. 99, fig. 21A, B; 1985b, p. 172, fig. 31, all as *M. lachnocarpus*); Logan River Branch SGAP (2005); Leiper *et al.* (2008).

Small trees 3–10 m high, stems up to 10 cm diameter at breast height with smooth grey or brown bark; young growth, branchlets, leaf-axes and inflorescences densely ferruginous villous with simple erect hairs 0.1–0.6 mm long; branchlets striate. Leaves with 2 (3 or 4) leaflets; leaflets opposite, coriaceous, elliptic or oblong-ovate, 5.5–13 × 2–5 cm (length: width ratio 3:1 to 2:1), slightly shiny, dark green above, paler below, slightly bullate, glabrous except for puberulent midrib and sometimes lateral veins above, pubescent below, dense along the midrib and lateral veins, mid-dense to sparse elsewhere, hairs simple up to 0.2 mm long (up to 0.5 mm along

midrib), margins recurved, apices obtuse or retuse, with small umbo < 0.5 mm long, bases obtuse or rounded, midrib sunken in a narrow groove above, prominently raised below; lateral veins 10–14 pairs, slender, patent, looping inside margins, slightly raised above, raised below; reticulation minute, prominent and slightly raised above and below; domatia present as small pockets or flaps at most lateral vein-midrib junctions below (occasionally at sublateral veins), 18–30 per leaflet, up to 0.5 mm long; petiolules pulvinate, 3–10 mm long, pubescent, channelled above; petioles slightly pulvinate, 10–36 mm long, pubescent, striate. Panicles axillary, in upper leaf axils, 1.5–7.5 cm long, axes and bracts ferruginous villous; bracts narrowly triangular,  $0.5\text{--}2.5 \times 0.2\text{--}0.7$  mm. Flowers white, 3–3.5 mm diameter; pedicels 1–2 mm long, pubescent, articulate at the base; calyx 5-lobed to near the base, lobes triangular to ovate,  $1\text{--}1.2 \times 0.7\text{--}0.8$  mm, pubescent outside,  $\pm$  glabrous inside, persistent; petals present, 4 or 5, rhombic, with rounded or obtuse apices, 1–1.3 mm long, sparsely pubescent outside,  $\pm$  glabrous inside, claw  $0.5\text{--}0.6 \times 0.2\text{--}0.3$  mm, scales 2, villous; disc annular, glabrous or with sparse hairs above. Male flowers: stamens 8 or 9, filaments 1.5–1.7 mm long, villous; anthers  $0.7\text{--}0.8 \times c. 0.5$  mm, sparsely puberulent; ovary rudimentary,  $c. 0.5$  mm long, villous. Female flowers: stigmas 3, recurved, papillose, remainder not seen. Capsules globular or subglobular, occasionally 2-lobed, 13–15 mm diameter, 14–18 mm long, with a brown pubescence of simple erect hairs 0.2–0.8 mm long outside, on stipes 5–6 mm long, 3–4 mm diameter, apiculate with remnants of style and stigmas to 2 mm long, yellow; loculicidally or septically dehiscent, valves drying crustaceous, glabrous or with an occasional hair along the sutures inside; seeds covered or almost so in a yellow or yellow-orange aril, aril connector folded lengthwise, 3–5 mm long extending to 12 mm and allowing the seed to hang down beyond the capsule. Seeds 1 or 2, shiny, globular or semi-spheroid with one flat side in 2-seeded capsules,  $10\text{--}13 \times 10\text{--}14.5$  mm, dark brown. Germination cryptocotylar. First seedling leaves subopposite, oblong-ovate,  $2.5\text{--}4.5 \times 2\text{--}2.7$  cm, sparsely puberulent; petioles 1–2 mm long. **Fig. 1.**

**Additional specimens examined:** **Queensland.** MORETON DISTRICT: near Lyrebird Ridge Road, Springbrook, Dec 1990, *Birds.n.* (BRI [AQ502591]); Repeater Station Road, Springbrook, Dec 1993, *Bean 7185* (BRI); Springbrook Lookout, MacPherson Range, Dec 1915, *White s.n.* (BRI [AQ118673]); between portions 150 & 94 Numinbah, NW of Hardys Falls, W side of Springbrook Plateau, Mar 1979, *McDonald 2821* (BRI); Canyon Circuit Track, near Ngarri-dhum Falls, Warrie National Park, Springbrook, Jun 1978, *McDonald 2071* (BRI). **New South Wales.** NORTH COAST: Mt Warning, Jul 1965, *Hayes s.n.* (BRI [AQ118670]); Mt Warning, Mar 2009, *Halford Q9670* & *Guymer* (BRI, NSW); walking track to Mt Matheson, Nightcap National Park, Mar 2009, *Halford Q9673* & *Guymer* (BRI, NSW).

**Distribution and habitat:** *Mischocarpus ailae* is known from the Mount Warning (Wollumbin) caldera, ranging from the Springbrook plateau, south-east Queensland to Mt Matheson, and also on Mt Warning, north-east New South Wales. It occurs in complex or simple notophyll vine forest (Regional Ecosystems 12.8.3, 12.8.5 and 12.11.1) on basalt, rhyolite or metasediments between 950 to 700 m altitude (to 100 m altitude if localities of Floyd below are confirmed).

W.J.F. McDonald, Queensland Herbarium (*pers. comm.* 2009) has recorded this species in SE Queensland from Upper Mudgeeraba Creek, near Mt Gannon, Fairview Mountain (Springbrook N.P.) and Cave Creek, Numinbah Valley. Floyd (1977, 1989, 2008) records this species from Mount Nardi, Boomerang Falls, Billinudgel, Huonbrook and Upper Crystal Creek, and the following Nature Reserves: Andrew Johnson Big Scrub, Goonengerry, Inner Pocket, Mooball and Numinbah in New South Wales. No specimens have been seen from these localities.

**Phenology:** The species flowers from November to January and fruits from February to April, or in July.

**Affinities:** *Mischocarpus ailae* has been confused with *M. lachnocarpus* in the past as both species have similar leaves. However, *M. ailae* is readily distinguished from *M. lachnocarpus* by its flowers with 4 or 5 petals (*cf.* absent), its villous filaments (*cf.* glabrous), and capsules that are yellow (*cf.* red or orange-red), globular or subglobular (*cf.* trigonous), larger (13–15 mm diameter *cf.* 5–8.5 mm diameter) and glabrous inside (*cf.* hairy along sutures inside), and its seeds with a yellow or orange aril (*cf.* purple or blue aril).

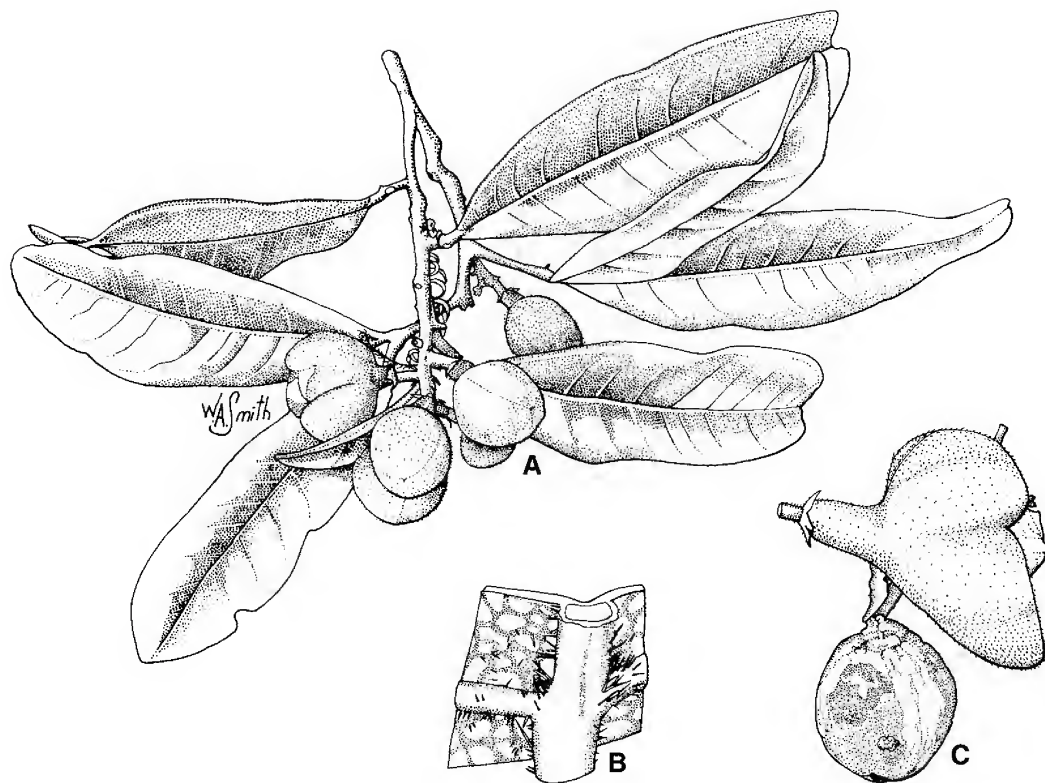


**Fig. 1.** *Mischocarpus ailae*. A. fruiting branchlet  $\times 0.8$ . B. dehiscent capsule with seed  $\times 1.5$ . C. domatia on lower leaf surface  $\times 10$ . All from Halford Q9671 & Guymer (BRI). Del. W. Smith.

*Mischocarpus ailae* is not closely allied to any other species within the genus. However, the yellow capsules, orange or yellow aril, presence of petals and pilose filaments indicate some affinity to *M. exangulatus* (F.Muell.) Radlk.

**Notes:** The species was first collected by C.T.White from Springbrook in 1915 and it was identified as possibly *Ratonia lachnocarpa* (= *Mischocarpus lachnocarpus*). Van der Ham (1977) identified this collection and Hayes' from Mount Warning as *M. lachnocarpus* and believed that the flowers of the two collections were abnormal as "they consist of several whorls of bracteole-like, sepaloid, and petaloid scales between which no distinct limits can be drawn ....a disk is hardly present". Recent flowering collections show the sepals and petals are normally developed as is the disk.

Reynolds (1985a, 1985b) description of *M. lachnocarpus* capsules included those of *M. ailae* (based on McDonald 2821) and so an amended description of the capsules of this species follows. *Mischocarpus lachnocarpus* has capsules that are red or red-orange, trigonous, 5–8.5 mm diameter, with dense brown pubescence outside of simple erect hairs 0.4–1.2 mm long, on stipes 4–7 mm long and 1.4–1.6 mm in diameter, apiculate with remnants of style and stigmas 1–1.5 mm long; loculicidally dehiscent, valves drying crustaceous and golden-brown villous inside along sutures, and the seeds covered or almost so in a blue or purple aril (see Williams (1984, p. 203), Nicholson (1994, p. 47) and Cooper & Cooper (1994, p. 193; 2004, p. 497) for coloured illustrations).

**Conservation status:** *Mischocarpus ailae* has a restricted area of occurrence of about 750 km<sup>2</sup> within the Mt Warning caldera. Its

natural extent most likely declined early last century when the Springbrook Plateau was cleared of vegetation. However, existing populations of it are conserved in National Parks (Springbrook and Nightcap) and Nature Reserves, and it is not threatened at this time.

**Etymology:** The species is named for Dr Aila Keto (1943–), founder and President of the *Australian Rainforest Conservation Society*,

who has made major contributions to the conservation of Australia's rainforests and their World Heritage listing.

**Common name:** woolly brush apple (Floyd 1977). Harden (1991) gives the common name as woolly pear-fruit but this applies to *Mischocarpus lachnocarpus*.

### Key to *Mischocarpus* species in Australia

- 1 Domatia present, as domes, pockets or small pits along the midrib of the leaflets below . . . . . 2
1. Domatia absent . . . . . 9
- 2 Leaves with 6–12 leaflets, white and papillose below together with appressed fine simple brown hairs, usually with a solitary dome domatium near the base. NE Qld . . . . . **M. albescens**
2. Leaves with 2–6 leaflets; leaflets green or pale green below (not papillose), with cavity, pit or 1 or more dome domatia. . . . . 3
- 3 Domatia as conspicuous raised pockets or domes . . . . . 4
3. Domatia as small pits or pockets (not raised). . . . . 6
- 4 Leaflets 2–6, obovate-oblong, elliptic or ovate, 3.5–11.5 × 1.5–6.5 cm; domatia 1–7 per leaflet, raised domes near base of leaflet below . . . . . 5
4. Leaflets 5–8, elliptic to ovate, 5–18 × 1.5–8 cm; domatia 5–16 per leaflet, raised pockets along midrib below. McIlwraith Ra. to Paluma, N Qld . . . . . **M. exangulatus**
- 5 Leaflets 2–4, domatia 1 or 2 at base of each leaflet; petals absent; filaments glabrous; capsules villous inside; aril purple. Daintree, NE Qld to Richmond River, NSW . . . . . **M. anodontus**
5. Leaflets 2–6, domatia 1–7 per leaflet; petals present; filaments villous; capsules glabrous inside, aril orange. Thornton Peak to Mt Bartle Frere, above 950 m altitude, NE Qld . . . . . **M. montanus**
- 6 Leaflets pubescent below; domatia 10–30 per leaflet as small concealed pockets along midrib at most lateral veins . . . . . 7
6. Leaflets glabrous below; domatia 4–20 per leaflet, visible with a hand lens as small pits c. 0.5 mm diameter . . . . . 8
- 7 Flowers with petals; stamens with pilose filaments; capsules globular or subglobular, yellow, 13–15 mm diameter on stipes 5–6 mm long, glabrous inside; seeds with yellow or yellow-orange aril. Mt Warning caldera: Springbrook, SE Qld to Mt Matheson, NE New South Wales . . . . . **M. ailae**
7. Flowers without petals; stamens with glabrous filaments; capsules trigonous, red or red-orange, 5–8.5 mm diameter on stipes 4–7 mm long, villous inside; seeds with blue or purple aril. Bamaga to Paluma, NE Qld & New Guinea . . . . . **M. lachnocarpus**

- 8 Leaflets 4–6, vernicose above; capsules on stipes 10–22 mm long, sparsely villous inside, septa glabrous. Cape York to Eungella, Qld . . . . . **M. stipitatus**
8. Leaflets 2–4, shiny above; capsules on stipes 3–6 mm long, densely villous inside including septa. Gympie, SE Qld to Williams River, NSW . . . . . **M. australis**
- 9 Leaves with 8–10 leaflets, 22–50 × 8–20 cm; leaf rachis 13–60 cm long. Wet Tropics, NE Qld . . . . . **M. grandissimus**
9. Leaves with 4–8 leaflets 4–18 × 1–8 cm; leaf rachis less than 12 cm long. . . . . 10
- 10 Petals present; stamens with pilose filaments; leaflets with indistinct lateral veins; aril orange or red. Wet Tropics NE Qld to NE NSW . . . . . **M. pyriformis**
10. Petals absent; stamens with glabrous filaments; leaflets with conspicuous lateral veins; aril blue or purple. . . . . 11
- 11 Capsules subglobose 6–10 mm diameter on stipes 9–12 mm long; valves sparsely appressed villous inside; leaflets glossy or vernicose above; aril partly enclosing the seed, pale purple or blue. Cape York to Eungella, Qld. . . . . **M. stipitatus**
11. Capsules trigonous, obovoid, 12–14 mm diameter on stipes 9–13 mm long; valves glabrous inside; leaflets matt or slightly shiny above; aril completely enclosing the seed, dark purple or blue. Atherton to Eungella, Qld . . . . . **M. macrocarpus**

## Acknowledgements

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## SHORT COMMUNICATION

The identity of *Centaurea riparia* DC. (Asteraceae)

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As part of my *Flora of Australia* treatment for the genus *Centaurea* L., Tribe *Cardueae* (Asteraceae), it was necessary to account for all names listed in the *Australian Plant Name Index* (Chapman 1991), i.e. those which either have an Australian type or that have been used in Australia. One name, *Centaurea riparia* DC., based on an Allan Cunningham collection from the Hastings River, has never been otherwise accounted for in Australian literature.

Upon examination of the microfiche of the type specimen, I immediately recognised it as the species currently called *Centratherum australianum* (K.Kirkman) A.R.Bean, of the Tribe *Vernonieae* (Bean 2004). Several parts of the protologue (de Candolle 1837) offer confirmation of this identification: de Candolle stated that the flower-heads are ‘bracteate’; that the exterior involucre bracts are shortly acuminate while the interior ones are coloured and somewhat denticulate; that the achenes are obscurely 10-nerved; and that the pappus is “caducissimus”.

Leafy bracts are a distinctive feature of *Centratherum* Cass. The inner and outer involucre bracts of *Centratherum* are as described in the protologue. The achenes of *Centratherum* are indeed 10-ribbed, and the pappus falls off at the slightest touch.

*Centaurea riparia* is an earlier name for the species currently called *Centratherum australianum*, and therefore a new combination in *Centratherum* is necessary. The type specimen was collected by Allan Cunningham from the “herb-filled riverbanks” of the Hastings River near Port Macquarie. He

would have collected it in May 1819, during P.P.King’s 2<sup>nd</sup> voyage of exploration (Curry & Maslin 1990).

***Centratherum riparium* (DC.) A.R.Bean, comb. nov.**; *Centaurea riparia* DC., *Prodr.* 6: 602 (1837). **Type:** New South Wales. Hastings River, near Port Macquarie, undated [May 1819], *A.Cunningham s.n.* (holo: G-DC, microfiche seen).

*Centratherum punctatum* subsp. *australianum* K.Kirkman, *Rhodora* 83: 21 (1981); *C. australianum* (K.Kirkman) A.R.Bean, *Austrobaileya* 6: 977 (2004), **syn. nov.** **Type:** New South Wales. West of Wingham on Bulga road, 12 April 1953, *J.Vickery 23846* (holo: NSW; iso: L, MO).

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## SHORT COMMUNICATION

Rediscovery of *Uncaria cordata* (Lour.) Merr. var. *cordata* (Rubiaceae: *Naucleaeae*) in AustraliaAndrew J. Ford<sup>1</sup> and Jack W. Hasenpusch<sup>2</sup><sup>1</sup>CSIRO Sustainable Ecosystems, Climate Adaptation Flagship, Tropical Forest Research Centre, P.O. Box 780, Atherton, Queensland 4883, Australia<sup>2</sup>Australian Insect Farm, P.O. Box 26, Innisfail, Queensland 4860, Australia

*Uncaria* Schreb. (Rubiaceae: *Naucleaeae*) comprises approximately 34 species distributed in central America, south-east Asia, Malesia, the western Pacific, Australia and Africa (Ridsdale 1978). All species are vines, characterised by the presence of persistent woody hooks at stem nodes and on old inflorescences. These hooks are the climbing agents within the genus and represent reduced and modified branches from one of the two axillary buds (Ridsdale 1978). Robbrecht (1988) placed *Uncaria* in the tribe *Cinchoneae* within the subfamily *Cinchonoideae*, although it is now accepted to be in the tribe *Naucleaeae* (Razafimandimbison & Bremer 2002). The tribe *Naucleaeae* is distinguished from other tribes in Rubiaceae by having the combination of “numerous flowers arranged in globose inflorescences and epigynous floral nectaries deeply embedded in hypanthia” (Razafimandimbison & Bremer 2002).

Currently, three species of *Uncaria* are recorded for Australia (Cooper & Cooper 2004; Forster & Halford 2007), with all species restricted to Queensland, although none are endemic. *Uncaria callophylla* Blume ex Korth. is found on far northern Cape York Peninsula, *U. cordata* (Lour.) Merr. var. *cordata* is known only from between Gordonvale and Innisfail (south of Cairns), and *U. lanosa* var. *appendiculata* (Benth.) Ridsdale occurs discontinuously from the Iron Range area on Cape York Peninsula to the Tully River. See **Fig. 1** for illustrations of all species.

*Uncaria cordata* was first recorded for Australia in 1922 based on a collection by C.T. White from Mt Bellenden Ker at c. 450 m altitude. Until recently, this remained the only known collection of the species from Australia.

Following severe Tropical Cyclone “Larry” in March 2006 numerous landscape scale vegetation surveys (to assess exotic weed species occurrences) were undertaken in affected rainforest areas by researchers at CSIRO, Atherton including the first author. Cyclone “Larry” crossed the coast in the Innisfail area (south of Cairns) and proceeded in a westerly direction across the Atherton Tableland. “Larry” was a high category 4 cyclone whose winds produced anything from severe to slight forest damage and was regarded as a once in 50 year event (Turton 2008). One of these surveys, in April 2007 at the Australian Insect Farm (Hasenpusch 1999) on the Seymour Range, north of Innisfail, recorded the second collection of *Uncaria cordata* from Australia at an altitude of c. 70 m.

***Uncaria cordata*** (Lour.) Merr., *Interpr. Herb. Rumph.* 479 (1910); *Restiaria cordata* Lour., *Fl. Cochinch.* 639 (1790); *U. cordata* var. *cordata*, Ridsdale, *Blumea* 24: 75 (1978). **Type:** *Loureiro s.n.* (BM), *fide* Ridsdale (1978: 74–75).

For full synonymy see Ridsdale (1978: 74–75).

**Specimens examined:** Queensland. COOK DISTRICT: [Mt] Bellenden Ker, Mar 1922, *White 1272* (BRI); Australian Insect Farm, off Davis road near Garradunga, Seymour Range, Apr 2007, *Ford AF4998 & Jensen* (BRI, CNS).

**Distribution and habitat:** *Uncaria cordata* var. *cordata* occurs from Burma and Thailand

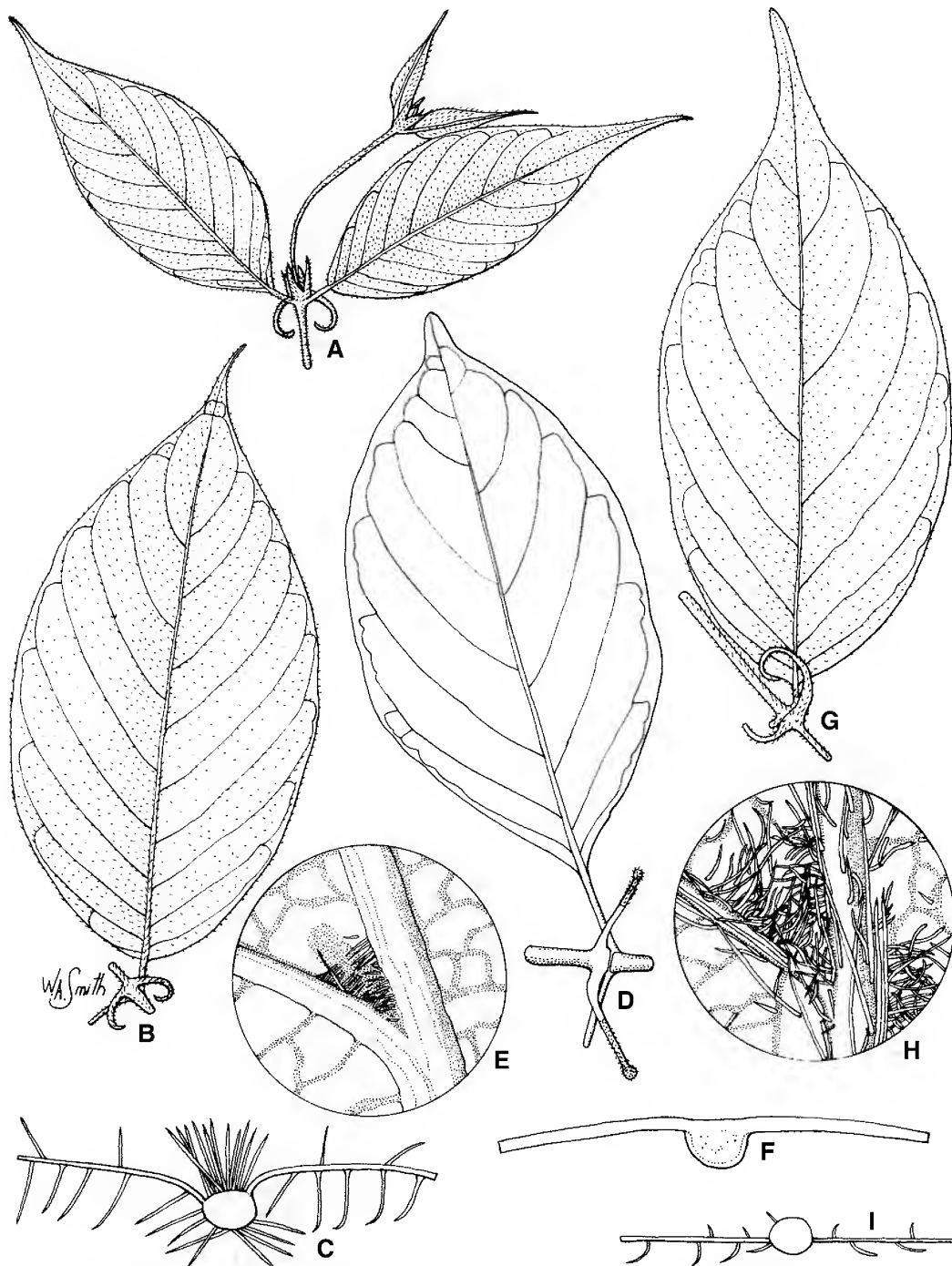


**Fig.1.** A–C, *Uncaria cordata* var. *cordata*. A. branchlet showing habit, paired hooks and stipules  $\times 0.6$ . B. abaxial surface of leaf blade and hooks  $\times 0.6$ . C. cross section of leaf blade showing depressed midrib and rigid hairs  $\times 20$ . D–F, *U. callophylla*. D. abaxial surface of leaf blade and hooks  $\times 1$ . E. abaxial surface showing domatia at midrib-lateral vein junction  $\times 20$ . F. cross section of leaf blade showing flush midrib  $\times 20$ . G–I, *U. lanosa* var. *appendiculata*. G. abaxial surface of leaf blade and hooks  $\times 1$ . H. abaxial surface showing domatia at midrib-lateral vein junction  $\times 20$ . I. cross section of leaf blade showing raised midrib and hairs  $\times 20$ . A–C Ford AF4998 (BRI), D–F Hyland 10953 (BRI), G–I Ford AF4075 (BRI). Del. W.Smith.

to the Philippines, throughout Malesia (including New Guinea), reaching a southern limit in Australia. In Australia it is confined to the Wet Tropics bioregion in north-eastern Queensland, where it is currently known from only two localities. Although habitat data for the Mt Bellenden Ker area where White collected his specimen from are lacking, the vegetation at c. 450 m is likely to be mesophyll rainforest on a granite substrate. On the Seymour Range the substrate is metamorphic (schists, gneisses and metasediments) whilst the vegetation is similarly mesophyll rainforest. Common canopy species on the Seymour Range in association with *Uncaria cordata* include: *Backhousia bancroftii* F.M.Bailey & F.Muell. ex F.M.Bailey, *Cardwellia sublimis* F.Muell., *Carnarvonia araliifolia* F.Muell. var. *araliifolia*, *Elaeocarpus bancroftii* F.Muell. & F.M.Bailey, *Endiandra montana* C.T.White, *Flindersia bourjotiana* F.Muell., *Flindersia pimenteliana*

F.Muell., *Macadamia whelanii* (F.M.Bailey) F.M.Bailey and *Musgravea heterophylla* L.S.Sm. Common small trees and shrubs on the Seymour Range include: *Apodytes brachystylis* F.Muell., *Brombya platynema* F.Muell., *Cryptocarya lividula* B.Hyland, *Cyclophyllum multiflorum* S.T.Reynolds & R.J.F.Hend., *Dysoxylum klanderii* F.Muell., *Hernandia albiflora* (C.T.White) Kubitzki, *Pittosporum rubiginosum* A.Cunn., *Polyscias australiana* (F.Muell.) Philipson and *Symplocos paucistaminea* F.Muell. & F.M.Bailey. The vegetation at these two localities fall within two Regional Ecosystems: 7.12.1a and 7.11.1a. (see [www.derm.qld.gov.au/redd](http://www.derm.qld.gov.au/redd)).

**Phenology:** Flowers are unknown in Australia; fruits have been recorded in March.

**Notes:** The Australian species of *Uncaria* may be distinguished with the following identification key.

- 1 Leaf upper surface glabrous, domatia present as tufts of hairs on lower surface. . . . . **U. callophylla**
1. Leaf upper surface variously hairy, domatia present or absent. . . . . 2
- 2 Midrib, lateral and minor venation depressed above on dried material; domatia absent . . . . . **U. cordata**
2. Midrib and lateral venation raised above, minor venation flat above; domatia present . . . . . **U. lanosa** var. **appendiculata**

**Conservation status:** Assuming that the Mt Bellenden Ker (Wooroonooran National Park) population is extant, although not verified, that would be the only occurrence of *Uncaria cordata* within the World Heritage Area (WHA) of the Wet Tropics. The Seymour Range population is on private land outside of the WHA and is currently known to comprise six individual plants, none of which have been seen fertile. The linear geographical separation of these two populations is c. 25 km. The regional ecosystems in which these populations occur are common both around and between these populations, so there appears to be plentiful potential habitat; however, no additional recordings of *U. cordata* have been made. This is remarkable given that it is a conspicuous species and co-occurs with *U. lanosa* var. *appendiculata* on the Seymour

Range. At the base of Mt Bellenden Ker *U. lanosa* is not an uncommon vine and has been collected numerous times within the known range of *U. cordata*. Presently *U. cordata* is classed as **Rare** under *Queensland Nature Conservation Act (Wildlife) Regulation 2006*; however, we consider it to be at risk at this time due to the single verified population and small number of individuals within Australia. As pointed out by Fell (2007), there is a need to acknowledge the “difficulties in attributing conservation status to taxa which are rare in Queensland....., but widespread in neighbouring regions”, such as Malesia (including New Guinea). We suggest that within Australia, *U. cordata* has an extent of occurrence no more than 250 km<sup>2</sup> and an area of occupation no more than 10 km<sup>2</sup>. *Uncaria cordata* could be allocated the status

of **Vulnerable** as it satisfies Criteria D1 and D2 of the IUCN (2001); however, this may be premature until more thorough searches for this species are undertaken in the Wet Tropics.

### Acknowledgements

The authors wish to thank Will Smith for the fine illustrations; Caroline Bruce, Matt Bradford and an anonymous reviewer for useful comments on an earlier version; Catherine Gallagher (MEL) examined material held at MEL and the curators and staff at BRI and CNS allowed access to specimens and the use of their facilities.

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## SHORT COMMUNICATION

**Reinstatement of *Enydra woollsii* F.Muell.  
(Asteraceae: Heliantheae)**

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*Enydra* Lour. is a small genus of hydrophilous forbs that occurs in the tropics and subtropics of South America, Africa, Asia and Australia. The number of species is often quoted as ten (e.g. Stuessy 1977; Stanley & Ross 1986; Hajra *et al.* 1995). The accepted Old World species are *E. fluctuans* Lour., reported for south-east Asia, Australia and tropical Africa and *E. radicans* (Willd.) Lack, shared by tropical Africa and South America.

*Enydra woollsii* was described by F.Mueller from Australian material in 1863. Bentham (1867) placed *E. woollsii* into synonymy with *E. paludosa* (Reinw. ex Blume) A.DC., and *E. paludosa* was later relegated to synonymy with *E. fluctuans*. Descriptions and illustrations of Asian *Enydra fluctuans* (e.g. Soerjani *et al.* 1987; Hajra *et al.* 1995) strongly indicated to me that it was morphologically different to the Australian taxon. A comparison of herbarium specimens has confirmed this. The ecology of the Asian plant also appears different. While the Australian taxon is strictly terrestrial, *E. fluctuans* from Asia and Africa has been described as a “free-floating plant” (Lack 1980) or an “aquatic” (Hajra *et al.* 1995), and Nguyen (1993) stated that it “may sometimes clog water courses”. However, descriptions recording it “rooting at the nodes” (Lack 1980; Beentje & Ghazanfar 2005) suggest that it is partly dependant on soil substrate.

The Australian taxon is considered to be distinct from *Enydra fluctuans*, and the name *E. woollsii* is reinstated here for it.

The distribution of *Enydra fluctuans* is markedly disjunct from that of *E. woollsii*. It is notable that *E. fluctuans* extends no further

south than Java and no further east than Sulawesi, except for a naturalised occurrence in the Philippines reported by Merrill (1923). There is no known occurrence of *Enydra* in New Guinea (Koster 1979), nor in northern Queensland (Queensland Herbarium records). There is one specimen record at the Northern Territory Herbarium, collected near Darwin in 2002, from a plant apparently escaped from cultivation.

***Enydra woollsii* F.Muell.**, *Fragm.* 3: 139 (1863), as ‘*Enhydra Woollsii*’. **Type citation:** “In paludibus prope Manly Beach portus Jacksonii. W. Woolls”. **Type:** New South Wales. Manly Beach, *s.dat.*, *W.Woolls s.n.* (holo: MEL2159823).

Perennial forb to 100 cm across and 20 cm high, terrestrial; flowering stems prostrate or weakly ascending, well-branched, terete, solid, up to 3 mm diameter, not constricted at the nodes, glabrous. Leaves opposite, 3.5–8 cm long, 0.8–1.5 cm wide, lanceolate to narrowly-elliptic, with conspicuously serrated margins (3–7 teeth per side), base cuneate or attenuate, apex acute; petioles 2–5 mm long. Lamina with numerous yellowish oil glands, and sometimes with a few ciliate hairs along the midrib. Capitula axillary, solitary, many-flowered, radiate, peduncles 0–2 mm long. Involucral bracts 4, in two opposite pairs, the outer ones longer than the inner. Outer bracts 4–10 mm long, with a longitudinal midvein and a network of secondary veins, midvein glabrous or with a few ciliate hairs, apex acute; paleae c. 4 mm long, sheathing the florets, with sessile glands on the distal margin; ray florets female, greenish-yellow to yellow, 3-lobed, zygomorphic, glandular; stigma bifid. Disc florets yellow, 4 or 5-lobed. Achenes black, narrowly obovoid but curved on outer surface, 2.4–2.7 mm long, finely longitudinally striate, pappus absent.

**Additional selected specimens examined: Queensland.** WIDE BAY DISTRICT: Eli Creek, 5 km N of Happy Valley, Fraser Island, Nov 1994, *Bean 8072* (BRI). MORETON DISTRICT: Alexander Clark Memorial Park, Loganholme, Jan 1995, *Bean 8184* (BRI); end of Wallaby Way, Pimpama, May 2003, *Bean 20424* (BRI); near landing ground, Aug 1998, *Dowling W281 & Stephens* (BRI). **New South Wales.** Mangrove Creek, c. 3 km upstream from Back Channel off Clarence River, N of Maclean, May 2005, *Phillips 1299 & Phillips* (BRI); Seale Road, 9 km ESE of Kempsey, Dec 2007, *Bean 27131* (BRI).

**Distribution and habitat:** *Enydra woollsii* extends from near Bundaberg in Queensland to Sydney in New South Wales. It is confined to areas within a few kilometres of the coast, and on some adjacent islands. It inhabits poorly

drained flats beside rivers and creeks that may often be tidal. These areas may occasionally be inundated by fresh or brackish water. The plant communities in such places are often dominated by *Casuarina glauca* Sieber ex Spreng. or *Melaleuca quinquenervia* (Cav.) S.T.Blake. Sometimes it grows in swampy areas behind frontal beach dunes where *Casuarina equisetifolia* L. is present, and where some salt would be received from maritime winds.

**Notes:** *Enydra woollsii* differs from *E. fluctuans* in several significant ways, as outlined below in **Table 1**.

**Table 1. Character differences between *Enydra fluctuans* and *E. woollsii***

|                         | <i>Enydra woollsii</i>                        | <i>Enydra fluctuans</i>                        |
|-------------------------|-----------------------------------------------|------------------------------------------------|
| Habitat                 | terrestrial                                   | semi-aquatic to aquatic                        |
| Habit                   | flowering stems prostrate or weakly ascending | flowering stems more or less erect             |
| Lower stems             | solid, to 3 mm diameter                       | hollow, 5–10 mm diameter                       |
| Leaf base               | cuneate                                       | hastate                                        |
| Leaf margins            | strongly serrate, with 3–7 teeth per side     | obscurely serrulate, with 10–20 teeth per side |
| Petioles                | 2–5 mm long                                   | 0–2 mm long                                    |
| Outer involucrel bracts | 4–10 mm long                                  | 11–20 mm long                                  |
| Palea indumentum        | sessile glands only                           | sessile glands and ciliate hairs               |

**Acknowledgements**

I am grateful to the Director of SING for sending specimens of *Enydra fluctuans* on loan, to Brendan Lepschi for sending an image of the type of *E. woollsii*, and Tony Orchard (Australian Botanical Liaison Officer 2008–2009) for confirming the absence of type material of *E. woollsii* at K.

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